# Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.

VOL. LIV. NEW YORK, THURSDAY, DECEMBER 23, 1909. No. 26.

PUBLISHED WEEKLY BY THE

## McGraw Publishing Company

239 WEST THIRTY-NINTH STREET, NEW YORK.

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TERMS OF SUBSCRIPTION:

United States, Cuba and Mexico.....per year, $3.00
Dominion of Canada.....per year, 4.50
Other Foreign Countries within the Postal Union.....per year, 6.00
25 shillings. 25 marks. 31 francs.

Foreign subscriptions may be sent to our European office.

Requests for changes of address should be made one week in advance, giving *old* as well as new address. No copies of issues prior to January, 1908, are kept on sale, except in bound volumes.

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Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Thursday of the same week.

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Entered as second-class matter at the post office at New York, N. Y.

*The circulation of Electrical World for* 1908 *was* 898,000. *Of this issue* 17,000 *copies are printed.*

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### WIRELESS TELEGRAPH REGULATION.

Representative Roberts, of Massachusetts, has introduced in the House at Washington a resolution, as noted elsewhere, providing for a board to govern the operation of wireless telegraph stations, afloat and ashore. We most sincerely hope that Congress will give effect to the resolution, for the need of some kind of regulation of the use of the ether has become a crying one. As pointed out by Representative Roberts, the abuse of the present freedom of wireless operation on the part of amateurs is abominable, not only through interference with commercial working but, not infrequently, in violation of decency. Reference might also have been made to malicious interruptions of transmission by commercial rivals—occurrences happily now less frequent than formerly. One feature of the resolution that deserves particular commendation is that providing for a non-military majority on the proposed board. Usually proposals for wireless regulation have been based upon the assumption that the ether is an appanage of war, and that since in time of peace nations should prepare for war, the military control should at all times be supreme. The proposed board would doubtless give little countenance to any proposition that would confer precedence on a social message from a military source over communications relating to the business of the world.

### VECTOR DIAGRAMS OF POLYPHASE WINDINGS.

The subject of polyphase armature windings has received a new impetus of recent years, owing to the use of polyphase generators for the supply of single-phase currents to electric railway systems. The conditions are here somewhat peculiar, because in order to supply a polyphase system, a polyphase generator is necessary, while in order to supply a single-phase system, a single-phase generator is not necessary, a polyphase generator being available. In this case, the choice between a single-phase and a polyphase generator is a matter of expedience, cost and incidental utility. The article by Mr. M. V. Ayres, on page 1521 of this number, discusses the general case of an armature provided with six slots per pole. Two subtypes of this structure are considered, namely, two full-pitch coils per slot, and one full-pitch coil per slot. As might be expected, the deductions show that the former subtype has the greater flexibility, and is capable of affording a greater variety of combinations.

A number of interesting deductions are reached in the article. Salient among them is the proposition that in any polygonally tapped single-reentrant closed armature-winding of full-pitch coils, all designed for the same current strength, the output is the product of that current and the perimeter of the selected polygon inscribed within the e.m.f. vector diagram. This is a beautiful and easily remembered generalization. It shows at a glance how much advantage a polyphase or polygonal tapping has over a simple single-phase or diametral tapping. It also

shows that a quarter-phase or two-phase tapping is superior to a three-phase tapping, in this type of winding used in rotary converters. Moreover, in such windings the quarter-phase system is actually a four-phase system, because within the generator armature there are four currents, of phases a quarter cycle apart. Another salient deduction from the article is that the three-phase connection of coils in the ordinary armature winding is, strictly speaking, not of the three-phase, but of the six-phase type, and enjoys, therefore, the advantage in point of output that the perimeter of a hexagon has over the perimeter of a triangle, when both are inscribed within the same circle. Consequently, the ordinary three-phaser of this type is superior in efficiency to the corresponding two-phaser, although in the closed simply-reentrant arrangement of a rotary converter the case is reversed. It is interesting to see in how many ways a polyphase winding can be connected up to furnish one single-phase alternating current. As regards output, none of them appears to be superior to a diametral connection of a rotary-converter winding; but for particular reasons this form of connection is not the favorite in practice. A certain connection carried across the center of symmetry of a delta winding is advocated in the article as offering special advantages.

## Electrical Christmas Presents.

This year, to a greater extent than ever before, electrical dealers are calling the attention of the general public to the desirability of buying electrical appliances as Christmas presents. With a widespread use of electricity in the home there has followed an opportunity of making gifts suitable for either men or women, while there is now available a large stock of electric toys for the children. To some extent this opportunity for an electrical participation in holiday trade is met by general merchants and department stores, but central stations and electrical supply dealers are proving by advertising in the daily newspapers and by the use of other advertising methods that they appreciate this growing demand—a demand which could be still further encouraged, no doubt, by judicious publicity; that is, directing the minds of the public, not only at gift-buying seasons, but at other times, to the manifest advantages of a varied list of electrical conveniences. Only the outer edge of this field has been touched, and the holiday season forms a particularly appropriate time to call attention to what, to the great majority of the people, are still novelties—attractive novelties, no doubt, but still rather apart from the needs and pleasures of daily life. It is to induce the public to consider electrical devices as everyday home comforts, and to remove the impression that they are unduly expensive, that the efforts of electrical dealers should be directed.

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It is not difficult to make a list of electric articles suitable for gifts, and no sheet of "Christmas suggestions" should now be complete unless it includes such a list. For the ladies, electric curling irons, little electric flatirons for traveling, electric chafing-dishes, coffee percolators, cereal cookers, toasters or disk stoves, a portable electric lamp, inexpensive or beautifully elaborate; a sewing-machine motor, or even an electric vacuum cleaner, may be considered appropriate. Men will appreciate electric-lighted shaving mirrors, electric shaving mugs, electric cigar lighters (doing away with burnt-match litter), a silk-hat iron and many other articles. Both men and women will find luminous radiators, foot warmers, heating pads, vibrators, ozone generators and the like useful. The children will rejoice in electric corn poppers, Christmas tree outfits and a bewildering array of toys, such as miniature railways, battleships, tiny street lamps and many mechanical devices. There is also the toy transformer, which reduces the e.m.f. of the 110-volt house circuit to the 3, 5, or 8 volts' pressure, or whatever may be required. Of course, the advantage of distributing these current-consuming devices, from the viewpoint of the electrical central-station man, is less the profit on the immediate sale than the prospect of a distinct, if small, increase of the connected load. For this reason the electrical interests themselves should be active in introducing these modern appliances.

## Determination of Ratio of Transformation and Phase Relations in Transformers.

In the measurement of alternating current and voltage, current transformers and voltage transformers are often either absolutely necessary or very convenient. By means of such transformers, a few standard measuring instruments can be employed over a wide range of voltage and current. At the same time, the precision of the measurement is affected by the precision with which the ratio of transformation can be assigned. Recently this subject was treated in these columns, and the current number of the *Bulletin* of the Bureau of Standards contains an interesting paper on the ratio and phase of such transformers. The paper defines the ratio of transformation of a potential transformer as the ratio of the primary terminal e.m.f. to the secondary terminal e.m.f. under the particular load applied, and the ratio of transformation of a current transformer as the ratio of the primary to secondary current. These ratios if interpreted vectorially are not mere numerics, but are plane vectors—that is, they involve a phase-angle as well as a numerical magnitude. This phase angle may appreciably affect the measurement in certain cases. It approximates to 180 deg., but may differ therefrom appreciably. Several methods are described for measuring the ratio, and its phase angle, in transformers, and a number of measurements are given in the light of a theoretical discussion.

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The effect of placing either non-inductive or inductive load upon a potential transformer is, in general, to increase the ratio of transformation, owing to the drop of pressure in the windings. On the contrary, the effect of an anti-inductive load is ordinarily to diminish the ratio of transformation, as that term is defined in the paper. In the case of a particular level transformer of 500 watts output-rating, the ratio increased nearly 4 per cent between no-load and rated load. On the other hand, a step-down potential transformer of 50 watts rating, 1100/110 volts, operated at 60 cycles per second, showed no appreciable change of ratio when the voltage was halved under constant secondary resistance. A slight decrease in ratio was observed with increase of frequency. As regards the angular phase difference from 180 deg., the measurements reported show that it is ordinarily very small in potential transformers operated at 60 cycles per second. In a particular case, it changed from about half a degree positive to a quarter of a degree negative between no load and rated load. Not far from half load there was no phase difference, or the secondary terminal voltage was

right opposite to the primary terminal voltage. In some of the current transformers tested, there was a very appreciable phase-difference between primary and secondary currents. In particular cases, however, with carefully selected apparatus, there was hardly any.

## TUNGSTEN LAMP LIFE.

It has been characteristic of the tungsten lamp ever since brought upon the market that, barring accidental breakages and a certain number of defective lamps which blacken rather quickly, the life of the new lamp in general has been long, and has increased with improvements in manufacture. Life tests made abroad also indicate long life at the usual efficiencies at which these lamps have been burned there. We are now apparently on the eve of a quite natural difference of opinion between the central stations and lamp users on the one hand, and the lamp manufacturers on the other, as to the relative weight to be assigned respectively to life and to efficiency. The central stations and the lamp users naturally want the lamp which will give the lowest cost for light, the cost of energy and lamp renewals both being counted. If, however, a good tungsten lamp has normally a life so long as to result in a considerable reduction of lamp-renewal sales, manufacturers are faced with a decrease in product as compared with carbon-lamp output. Certain central stations have, in fact, been for some time ordering lamps of a voltage higher than that of their circuits for the purpose of prolonging the life of the lamp and preventing in advance complaints of consumers about costly lamp renewals. The average user knows so little about lamp efficiency and life that he takes whatever the manufacturer or the central station gives him. It can be safely said that the larger central stations will eventually control the lamp situation as regards their own purchases as a matter of self protection. If they are convinced that lamps of lower efficiency than, say, 1.25 watts per horizontal candle, are best for their customers, all things considered, they will insist on getting such lamps, but small stations and users are, as before, dependent on the lamp manufacturers. The history of carbon lamps will doubtless repeat itself with the tungsten lamp—that is, the users who know nothing about the fact that the temperature of the filament governs lamp efficiency will ask for long-lived lamps without regard to efficiency. It will be interesting to see whether it will be possible to hold up the efficiency of the lamps in spite of this pressure.

## THE LAW OF RADIATION IN INCANDESCENT LAMPS.

An important paper by Féry and Chéneveau, abstracted in the Digest, has very direct bearing on the possibility of improved efficiency of incandescent lamps. So long as one depends for efficiency entirely upon elevation of temperature, even the best-known materials have very serious limitations. Further improvements have been closely bound up in the question of increased specific radiation. That tungsten and tantalum lamps give higher specific radiation than the older forms has been quite clearly shown by a number of experimenters. Nothing has as yet been published, however, which appears so definitely to show the amount of such improvement as the paper before us. Starting with Stefan's law for carbon lamps, the authors have gone on and enunciated an exponential relation between the luminous intensity and the energy which they have verified within wide limits. They appear to have shown that for the carbon lamp the luminous intensity is proportional to the cube of the energy only through a narrow range, the real law connecting the two being the exponential one. Modifications of theory of this character have often had to be made in other physical research. It is frequent that a given series of observations can be represented very accurately within a moderate range by some exceedingly simple law, sometimes even a linear one, which does not hold in the more general case that has to be considered when taking into account all the observations. Even in this latter case it is sometimes possible to find a simple law for several consecutive modest limits, so as to simplify the calculations.

Going on to the tungsten lamp, Féry and Chéneveau attempted to follow a similar process of evolution with respect to tungsten. Their method seems somewhat unsatisfactory in that it involved the perhaps somewhat considerable assumption that the law of radiation for tungsten would be closely similar to that for platinum, also a metal which is a fairly good reflector. Investigating by means of an optical pyrometer the relation between total radiation and temperature, they found that for platinum the law for connecting energy and temperature was not that of the simple 4th power of the temperature, as in the case of carbon, but of the 4.6th power. The next step, applying this law to the tungsten filament, was to determine the exponential relation between energy and luminous intensity corresponding to the temperature relation just stated. From the comparison of the figures thus obtained with those already secured with carbon, the authors deduced the temperatures with carbon and tungsten filaments as about 1780 deg. C. and 1875 deg. C., respectively. This difference is naturally considerably less than that obtained by previous investigators, taking less account of the question of specific radiative power. The specific efficiency they find from the exponential formula deduced to be practically three times as great for the tungsten filament as for the carbon, a figure which is in agreement with ordinary commercial experience. This result is particularly interesting as being derived from the establishment of empirical laws for the radiating capacities for the two materials.

The weak point in the argument seems to be the use of platinum as an intermediary. There can be little doubt that platinum and other metals which are good reflectors have a materially different law of radiation from black bodies. The previous experiments have not indicated that the law for various metals is substantially uniform. This, indeed, would seem to be a thing to be proved rather than to be assumed, but it is sufficiently evident from the results of this research that there is probably a larger variation in such metals from the laws of black body radiation than has heretofore been established. Whether it is so great as the present experimenters have found is another matter, and it would certainly be very desirable for them to repeat their pyrometrical experiments directly upon a tungsten surface. The difference in temperature deduced for carbon and tungsten filaments seems surprisingly small, and direct verification of the exponential formula for tungsten would seem desirable before accepting so large a difference in radiating capacity as here appears.

# J. P. Morgan in Telephone Field.

Clarence Brown, of Toledo, Ohio, attorney for James S. Brailey, Jr., has announced that the real purchasers of the stocks of the United States and Cuyahoga Telephone companies are J. P. Morgan & Company, of New York. He states they purchased the stocks for their own account and that the Bell companies are not interested in them either directly or indirectly. In addition Mr. Brown states that Messrs. Morgan & Company have purchased a majority of the stocks of the Toledo Home Telephone Company, the Columbus Citizens' Telephone Company, Columbus, Ohio; the Dayton Home Telephone Company, Dayton, Ohio; the Indianapolis Telephone Company, the New Long Distance Telephone Company and the New Telephone Company, all of Indianapolis. All of these purchases were made, Mr. Brown stated, with the firm's own funds and for its own investment, without consultation or arrangements with any other interests. The United States Telephone Company, he states, will continue to co-operate with the Independent companies of Ohio and Indiana as in the past, and the management will remain the same as at present. Mr. Brailey added to this statement the assertion that J. P. Morgan & Company will operate these properties permanently as their own and there will be no general holding company.

Mr. Brown, before making this announcement, held a conference with members of the firm of J. P. Morgan & Company, and on his return addressed a letter to the presidents of the various companies affected, in which appears the following: "I am authorized by J. P. Morgan & Company to advise that, in their opinion, the business should be conducted precisely as it has been in reference to the construction, maintenance and operation of the property, with a view to securing the best possible results for the stockholders consistent with the duty which the company owes to its patrons and the public. The properties should be not only fully maintained, but improved and developed as business warrants."

The first announcement of the sale of the stocks to J. P. Morgan & Company early in the week was considered by Independents to confirm the belief of the public generally that they would go into the hands of the Bell interests, and some of those whose stock was sold thought it merely a dodge to escape the trouble of legal proceedings. Attorneys for the Independents stated that the announcement had made their chances for winning in the injunction suits at Cleveland and St. Louis brighter, because of the supposed affiliation of the Morgan and Bell interests. The election recently of Henry P. Davison, of J. P. Morgan & Company, to the Western Union board as reorganized by the Bell interests is offered in evidence of a community of interests.

Late Monday evening motions were filed in Common Pleas Court for receivers for both the United States Telephone Company and the Cuyahoga Telephone Company, the purpose being to protect the minority stockholders, it was declared. This action was taken on amended petitions in the suits of Samuel J. Schweer and J. W. Otto. The allegation is made in connection with the motions that the voting trustees have not discharged their duties properly, and instead of protecting the interests of the stockholders are practically in the service of the Bell companies.

The motions for receivers followed the announcement that the toll rates on the lines of the United States Telephone Company had been advanced to the figures that prevailed before the cut made in competition with the Bell lines some months ago. This step was taken by the attorneys for the Independents to mean that the Bell people were actually in control and that nothing could be lost now if the advance did turn business to the Bell lines which still maintain the cut rates.

It is said that E. G. Tillotson, president of the Cuyahoga Telephone Company and member of the rate committee of the United States Telephone Company, opposed the advance at this time and that he refused to recommend or approve the move. Barney Mahler, who told on the stand that he had but one share of the stock, and James S. Brailey, Jr., signed the recommendation, it is said. An idea of the rates as they now stand may be secured from the figures between Cleveland and the following towns:

| | New rate. | Old rate. | Bell rate. |
|---|---|---|---|
| Akron | $.20 | $.15 | $.15 |
| Canton | .35 | .20 | .20 |
| Sandusky | .35 | .20 | .20 |
| Wooster | .35 | .20 | .20 |
| Youngstown | .40 | .25 | .25 |
| Columbus | .80 | .70 | .35 |
| Toledo | .65 | .60 | .30 |
| Dayton | 1.15 | 1.10 | .75 |
| Lima | .90 | .50 | .50 |
| Mansfield | .45 | .40 | .30 |

Mr. Mahler claims that the change will result in a reduction at as many points as it will advance. He said that special rates had been made to certain large users who were furnished coupon books, but that this had been abolished also and all customers will be treated alike. This, he said, is in line with the principles established for all public-service corporations and is as it should be. He has defended the move from the standpoint of the user as well as the stockholders.

So far as can be learned, local officers of the Bell companies have had no instructions to advance rates and there is at present no indication that a change will be made. As may be seen from the figures given, Bell rates have been lower to most points all along than those of the United States. As a result, the company has been doing a heavy business, but the abolishment of night rates helped to equalize matters. The night business had got so heavy that there was no reason for longer maintaining lower rates and it is believed that, equalized as they are, the aggregate receipts will not show so much difference as might be expected.

The rates of the Cuyahoga Telephone Company are now two-thirds of a cent a mile, the distance reckoned on an air line. This, the officials state, is a rate that will be fair to all.

Frank L. Beam, president of the Ohio Independent Telephone Association and one of the directors of the Citizens' Telephone Company of Columbus which sold a controlling interest in its stock some time ago, is quoted as saying that the Independents are well satisfied if J. P. Morgan & Company have purchased the stocks of the Ohio companies and that Mr. Brailey was told this at a meeting in Columbus some time before the announcement was made. It has been stated, however, that all the Independents are not of Mr. Beam's opinion and that there may be some discussion on this point at the next meeting of the State association.

Stories of defections on the part of some of the Independent companies are in circulation. It is stated that the Independent company at Ironton has closed negotiations for Bell long-distance service and that some of the other southern Ohio companies have the matter under consideration. Whether this is true cannot be ascertained at this time.

From Columbus it is reported that a bill is being prepared to regulate telephone rates and that it will come before the next General Assembly. This bill fixes a minimum charge for long-distance service and would act as a block in the way of merging the companies. In addition the bill seeks to put all telephone companies in the hands of a State commission, similar to the State Railroad Commission. It is said that the Independent companies desire the passage of this bill, now that the United States has increased its rates. The claim is made that the increase is so high that the company cannot command business in the face of the Bell rates. In this way people will be forced into the Bell service and only those who are not reached by Bell lines will have to pay the penalty of their misfortune in this respect. These people argue that the rates are being made prohibitive on purpose to force the business to the Bell lines.

E. W. Moore, of the Everett-Moore syndicate, on the stand in the deposition hearing before Notary Chestnutt last week, testified that James S. Brailey, Jr., had demanded a commission of $75,000 for putting through negotiations with certain Cincinnati and St. Louis parties. He said he considered this too much money to pay for the services and began to look to other possibilities. It was at this point that F. H. Goff came into the deal. He said that the anxiety to sell the securities of the com-

panies was caused by the condition of H. A. Everett's health and the necessity to clear up individual obligations existing among individual members of the syndicate. Mr. Moore was not aware of the fact that Mr. Brailey had anything to do with the transfer of the stocks until Mr. Goff spoke of his presence in New York when he was in consultation with the representative of R. L. Day & Company. He said that in the negotiations with Claud Ashborrk, of Cincinnati, and A. H. Bauer, of St. Louis, Brailey was acting only as agent, and that he had been paid $40,000 at one time for sales he had made. He put in evidence Brailey's letter regarding the evidence.

E. E. Newman, of the Cleveland Trust Company, submitted records of the transfers of stock that have been made since the sale was announced. James S. Brailey, Jr., has refused to appear and testify before Notary Chestnutt and as a result a fine of $50 has been assessed against him on the charge of contempt of court.

Attorney-General U. G. Denman is keeping a careful lookout for evidence that will connect the sale of the stock in any way with the Bell interests. In case evidence of sufficient weight and directness is obtained, it is the intention of the official to bring suit to prevent a merger or any arrangement that will bring about co-operation in rates and practices.

## Maryland Public Utilities Bill.

The Public Utilities Bill, which was recently drafted by the Attorney-General of the State of Maryland, and noticed in these columns last week, is being held under advisement by the Governor's commission, which has made several important changes in the document. The bill as it now stands provides that the salaries of the members of the commission are to be $8,400 for the chairman, and $7,500 each for the other two. The counsel is to receive $4,800 instead of $6,000, as originally proposed in the bill, and the salary of the stenographer was cut from $1,800 to $1,500. The aggregate salary list will be $35,200, of which the city of Baltimore will pay $15,600. The period of incumbency is left open until the commission may determine whether or not a period of six years is constitutional. The suggestion that two of the commissioners should be appointed from Baltimore was left open for further consideration. The counsel is to be appointed by the Governor upon the recommendation of the commission. Whether the members of the commission may hold stock or securities of any corporation coming under the jurisdiction of the commission was not definitely determined. Corporation earnings are to be restricted to a "reasonable return" on the capital, this to be determined by the courts in individual cases. As yet the question of perpetuity of contracts is not touched on in the bill.

## Street-Lighting Tables.

The street-lighting schedules which have been issued annually for many years by this journal form a supplement to the present number, and have this year been improved by the addition of an all-night lighting table based only on the times of sunrise and sunset, ignoring moonlight. According to the additional table, which is designated No. 1, the lamps are lighted one-half hour after sunset and are extinguished one hour before sunrise. By such a plan the lamps are in service for about 3830 hours per year. An "all-night" lighting schedule giving a total of about 4000 hours could be obtained by lighting 15 minutes earlier and extinguishing 15 minutes later than shown.

Table No. 2 is sometimes referred to as the "Philadelphia Moonlight Schedule." This schedule differs from that of Table 1 in that advantage is taken of moonlight, beginning with the fourth night after new moon—that is, after the moon has reached its first quarter. On moonlight nights the lamps are extinguished one hour after moonrise and lighted one hour before moonset, with the exception of the night before, the night of, and the night after full moon, when the lamps are not lighted. This schedule involves the use of the lamps for about 2000 hours per year.

Table No. 3 is calculated according to the well-known system of Mr. H. W. Frund, and ignores the moon until midnight throughout the year. After midnight the lighting hours are the same as in Table No. 1 except that the lamps are not used on the three nights before full moon. According to this schedule the lamps are used for about 3000 hours per year.

All of the tables are based on mean local time and are calculated for latitude 40 deg. north. They may be considered correct within 10 minutes for southern New York, Connecticut, Pennsylvania, Rhode Island, New Jersey, Ohio, Indiana, Illinois, Iowa, Delaware, Maryland, Virginia, West Virginia, Kentucky, Missouri, Kansas, Nebraska, Utah, Colorado, Nevada and northern California. They are also correct within 10 minutes for all places within the United States proper during the months of March, April, September and October. The maximum disagreements are reached in June, when the nights are shorter in the Northern than in the Southern States, and in December, when the reverse is the case. During these months the disagreement along the northern border of the United States and as far south as Charleston, Birmingham and Los Angeles will not exceed 20 minutes. A maximum disagreement of one-half hour may be assumed for Jacksonville, Fla., and Houston, Tex.

## New York Telephone and Telegraph Investigation.

At the legislative investigation into the affairs of the telephone and telegraph companies in New York, last week, Theodore L. Cuyler, treasurer of the New England Telegraph Company, testified that the Postal Telegraph Company of Connecticut received 34 per cent of the gross receipts of the New England Company under the existing contract. He said that he did not know the reason for this arrangement. He could not explain why the accounts of the two companies were interwoven and admitted that he really knew very little about the affairs of the company.

Edward J. Nally, president of the New England Telegraph Company, and vice-president of the Postal Telegraph Company of Connecticut, was also a witness before the committee. He testified that the charges of the telegraph companies had to be raised because the cost of labor and everything had advanced. He said that in April, 1907, as a result of numerous conferences between the tariff superintendents of the Postal and the Western Union Telegraph companies, advances were made in about one-half of the 7138 rates on the schedules. He said that the Postal companies lost money on the strictly New York business and that there was no profit in the railroad business. Mr. Nally said that for about 80 per cent of the business there was active competition between the Postal and the Western Union companies. The Postal's business from non-competitive points amounts to only about 15 per cent of its total. He said that the Mackay Companies owned practically all the stock of the two companies in which he held official position and that he consulted with Mr. Mackay or other officials of the big company about policy.

As a mark of respect to the memory of State Senator John Raines, who died last week, the committee suspended its hearings until after the holidays.

## Proposed National Wireless Telegraph Board.

Representative Roberts, of Massachusetts, has introduced a resolution in the House at Washington providing for the creation of a wireless telegraph board.

There is the greatest need for such control, Mr. Roberts said, as he has reports from the Navy Department, the revenue cutter service and the commercial wireless companies that the effect of the activities of amateur operators has been such as not only to make necessary a change from "C Q D" as the

distress signal, but to interfere seriously with the operations of all Governmental and private services. As a result of these reports Mr. Roberts, who is a member of the House Committee on Naval Affairs, considers it high time to take cognizance of the situation.

The perfection of wireless apparatus has reached such a stage, he said, that if the service is to be permitted to grow unchecked it is absolutely essential that the Government take steps in the matter. The simplest solution of the matter lies in the passage of the resolution presented, or a measure of similar character, placing in the hands of a wireless board the control of wireless plants afloat and ashore. It has been brought to his attention in an official way that the wireless service of the navy has been rendered practically useless at times by amateur operators, who send meaningless and oftentimes vile and unmentionable language through the air from their instruments.

Mr. Roberts's resolution authorizes the appointment of a board of seven members, "one expert each from the War, Navy and Treasury departments, three experts representing the commercial wireless-telegraph and wireless-telephone interests and one scientist well versed in the art of electric-wave telegraphy and telephony."

The duties of the board, according to the resolution, shall be "to prepare a comprehensive system of regulations to govern the operation of all wireless plants afloat and ashore which come under the cognizance of the United States, with due regard alike for Government and commercial interests."

It is provided that within 30 days of the organization of the board it shall submit its report and recommendations to Congress. To defray the expenses of the board $2,000 is appropriated.

## A French Electrical Bank.

A bank has been formed in Paris named the Société Centrale pour l'Industrie Électrique, which is expected to have a beneficial effect on the development of the electrical industry in France. This bank is along the same lines as similar establishments in other European countries, particularly in Germany, and the electrical banks of Zurich, Berlin and Brussels are among the stockholders of the French bank, which has also the support of several of the strongest banks of Paris. It is understood that the new bank will continue the close relations with the Allgemeine Elektricitäts Gesellschaft, of Berlin, and the French Thomson-Houston Company, which have existed between these companies and two of the large French banks interested in the new bank.

## Desplaines River Water-Power Case Taken to Federal Court.

As recently stated in these columns, the State of Illinois was defeated by a decision of the State Supreme Court in its attempt to declare the Desplaines River a navigable stream and to cause the removal of the water-power development works of the Economy Light & Power Company at Dresden Heights, Ill., as an obstruction. The State Supreme Court decided that the river was not a navigable stream in a legal sense, despite the fact that a great volume of water from the Chicago Drainage Canal has been turned into it in recent years.

Apparently the question is not settled, however, for by direction of the Attorney-General of the United States, a bill has been filed in the United States Circuit Court, Chicago, asking that the Desplaines River be declared a navigable stream, that the company be ordered to remove the structures already placed in the river in the building of its water-power development and that the company be enjoined perpetually from building a dam in the stream. The Government suit ignores the contracts between the Economy Light & Power Company and the Canal Commissioners of the State. The contention is that the State had no right to sell the title to the bed of the stream, as it was a navigable water-course under the control of the general Government. It is asserted that the rule in the Federal courts is that the mere fact that there are shallow places or rapids in portions of the river does not make it a non-navigable stream. The test, it is said, is whether by improvements the stream cannot be made navigable ultimately. If this view is upheld, the Economy Light & Power Company must obtain a permit from the War Department for the construction of the dam in question.

Governor Deneen convened the Illinois Legislature in special session on Dec. 14. He sent a long message to that body and among other things recommended legislation to provide for the construction of a deep waterway or canal from the present power plant of the Sanitary District of Chicago near Lockport (where the Drainage Canal enters the Desplaines River) to a point in the Illinois River near Utica, Ill. This proposition has been submitted to the citizens of the State and they have voted in favor of a constitutional amendment authorizing the issuance by the State of $20,000,000 in bonds in order to provide the funds necessary for the work. The Governor is very much in favor of the carrying out of this project. To this end he objects to the water-power development of the Economy Light & Power Company at Dresden Heights as interfering with the deep-waterway project, and in his message he urged that the case be taken to the United States Supreme Court, which has since been done, as related above.

## Telephone Traffic in Chicago.

Mr. B. E. Sunny, president of the Chicago Telephone Company, gave an interesting and instructive talk to the Electric Club of Chicago at the meeting on Dec. 15. Mr. Sunny began by saying that to disarm criticism he should declare at the outset that the telephone service in Chicago is the very best in the world. He then read from the "Instructions from Subscribers" issued by the Bell Telephone Company of Illinois in 1879. This company was one of the predecessors of the present Chicago Telephone Company, and the elaborate instructions to subscribers at that early day are amusing in view of present practice.

In 1879 the Bell company and the American District company (owned by the Western Union Telegraph Company) both had exchanges in Chicago. In 1882 the Chicago Telephone Company was organized and succeeded both companies. At that time it had about 3500 subscribers' stations. Now there are 30 telephone exchanges in Chicago and 205,000 telephones. The service requires a total of 575,000 miles of wire, of which 460,000 is underground. The number of four-party stations is 85,000; two-party stations, 31,000; single-line stations, 43,000. In addition there are 2075 private branch exchange switchboards, supplying over 40,000 stations. About 1,300,000 originating calls are handled in an ordinary business day. There are 10,500 trunk lines connecting exchanges. In the central business district there are about 52,000 telephones, connected principally to the Main, Central and Harrison exchanges.

In answering calls the operator's average speed is about four seconds. The total time necessary to secure a complete connection, on an average, is from 20 to 25 seconds. It is the company's aim to have all of the calls answered within a maximum of eight seconds. To some extent accuracy in telephone service is sacrificed to secure speed, for one of the chief advantages of telephone communication is that it is practically instantaneous; but, after all, the work of the operators is computed to be 94.5 per cent accurate. There is also an improvement in the matter of accuracy. In 1900 the number of written complaints was 229 per 1000 subscribers' stations; in 1909 the number of such complaints had been reduced to 38 per 1000 stations. This improvement is attributed to more efficient operating and a closer relation between the company and the telephone public. It has also been brought about to some extent by doing away with 10-party lines, for which 4-party lines have been substituted.

The number of "busy" responses to telephone calls is decreasing, and is now about 13 per cent of all calls made. Analyzing

the disposition of a day's traffic, it is found that 78.5 per cent of calls are completed without trouble, 13 per cent are held up on account of busy lines, 3 per cent are not made on account of no responses being received from the person called, 1 per cent are interfered with on account of double connections, cut-offs, etc.; 3 per cent go astray owing to wrong numbers due to operating irregularity, and 1.5 per cent are not made in the first instance on account of errors in giving the numbers on the part of the subscribers. In the traffic department about 3500 operators are needed, in addition to 500 supervisors and 274 other operating employees. These figures are for Chicago service alone. About 1250 operators and 275 supervisors are required at the time of maximum load, in addition to managers and other male employees. The busiest hour of the day is between 10 and 11 a. m., 10 per cent of the day's telephone business being done in this hour. The busiest minute of the day is 10:10 a. m., and the busiest day of the year is the day before Christmas.

Some branches of the service rendered by the company are not understood by the public. Thus, the number of requests received daily for the time will amount to about 60,000. The maximum number of such requests comes between 7 and 8 a. m. The company's pay-roll for operators is about $6,000 a day, and if the time taken for this service is charged pro rata, it costs the Chicago Telephone Company $300 a day to tell its subscribers what time it is. Another branch of the service whose magnitude is not generally appreciated is in transmitting fire alarms and police calls. In the month of October the company handled 1488 fire calls and 4084 police calls, and the telephone is an important adjunct to these departments of public safety.

The number of cases of trouble reported in one year is about 1,250,000, or about 6.7 reports per station, but many of these are of a temporary nature and clear themselves. The total number of actual cases of trouble cleared in the year was 452,000, or 2½ per station. The number of men employed by the inside plant department is 1446, of whom 429 are regularly employed on maintenance. Rain and thunder storms in the summer and snow and sleet storms in winter give the telephone company much trouble. A severe storm may easily double the normal number of troubles. In case of a severe storm, extraordinary measures are taken to meet the emergency, gangs of men being sent over all routes with orders to put all lines, regardless of actual cases reported. In many cases these gangs are given rigs to enable them to cover more ground and to carry more material. The severe sleet storm of Jan. 12, 1908, gave a test to the telephonic protective apparatus. There were 111 cases of trouble reported due to high-tension crosses, besides an undoubtedly large number where the lines were cleared up before the trouble was traced to its original source. In no case did the high-tension current get beyond the arresters in the offices, and the only fire noted was in the wiring of one station, which was probably due to current coming in over an unprotected telegraph wire.

In closing, Mr. Sunny indorsed the recent contention of Mr. Samuel Insull before the same club, to the effect that public utilities ought to be monopolies in their communities if they are to be of the highest efficiency. This is particularly so in the telephone situation. The telephone must connect with everybody the subscriber wishes to reach to make it of the greatest service. Obviously this is not apt to be the case where there are competing systems. The speaker indorsed the principle of regulation of public-service companies by municipality or State. Under its present ordinance, the Chicago Telephone Company gives 17 classes of service at fixed prices. The bookkeeping of the company is done under the supervision of the City Comptroller. The service is given under the direction of the Commissioner of Public Works, and the legal interpretation of the ordinance is made by the Corporation Counsel. The ordinance was granted in 1907, and the city may purchase the system in 10 years or in 15 years from that time. It expires in 1927, and during its life the city reserves the right to regulate the price of telephone service for five-year periods. A very exhaustive study by a commission is now under way to determine what all classes of telephone service actually cost. On a fair basis a rearrangement of the rates should permit of maintaining the high standard of efficiency which the company is desirous of continuing.

In the discussion Mr. Charles A. Brown spoke of the wonderful improvement in the service since the early days. He ascribed much of the credit for this to Mr. Sunny. Mr. K. B. Miller pointed out that the company is now adding every year as many subscribers as it had all together 10 years ago. Relating to the question of telephone competition, Mr. Miller was not disposed to agree that the question could be settled by the broad generalization laid down by Mr. Sunny. There is much to be said on both sides of this problem. Others who spoke briefly were Messrs. J. B. Ware, H. V. Bennis, Charles W. Price, F. J. Holmes, J. W. Johnson and F. P. Vose. Mr. W. B. Potter, engineer of the railway department of the General Electric Company at Schenectady, who was a visitor, was the last to speak. He mentioned delays in the English telephone service and traced a relation between electrical transmission of messages and electrical transportation of persons. He alluded to the smoke nuisance in Chicago, and hoped it would soon be abated.

## Trolley Car Destroys Wires in Nashville, Tenn.

Electric light, telephone, railway and telegraph companies of Nashville, Tenn., were recently put to no end of trouble by the destruction of their lines for eight blocks by a trolley car. The illustration herewith shows the scene of the wreck at noon of the day following, after large gangs of men had been at work clearing the street for 12 hours. The accident occurred shortly after midnight, when a Kain Avenue car was returning to the shed from its last trip. Someone had driven a wooden wedge in a frog, which threw the car, which was under full speed, from the track. The car crossed the street, and striking a telephone pole snapped it in two. Broad Street, on which the accident occurred, carries all the wires leading to South Nashville, and the weight of the wires and cables was such that the snapping of one pole resulted in the breaking of over half a hundred others. By actual count 60 heavily laden poles were down in the street, and cables and miscellaneous wires scattered all over. The Cumberland Telephone & Telegraph Company is said to have had over 3000 wires down, most of which were broken. The Nashville Railway & Light Company is said to have had 1500 wires in a mix-up, and besides the city's electric light and fire-alarm wires, the Western Union and Postal Telegraph companies had numerous circuits thrown out. The chief cause of the fall of the other poles has been attributed to 10 lead-covered telephone cables, which were said to have been too heavy for the poles. The management was about to place all of these lines in underground conduit, and it is claimed that necessary repairs were too long delayed.

POLE LINES DESTROYED BY TROLLEY CAR.

## Electricity for the Rand.

The Victoria Falls Power Company, which has been supplying electric energy to mines on the Rand for the past two years from stations at Brakpan and Germiston, has recently increased its generating and transmitting equipments. Two 3000-kw, 50-cycle, A. E. G. steam turbo-alternators designed for 10,600 volts, three-phase, have been installed at Brakpan. At Simmerpan four similar 3000-kw units have been erected and provision is being made for two additional units of the same rating.

The transmission line will shortly be extended from Modderfontein to Randfontein, a distance of about 40 miles. The conductors consist of two sets of copper cables measuring 120 sq. mm and 70 sq. mm in area, operated at 10,600 volts and 40,000 volts respectively. These conductors are supported on steel lattice masts, 40 ft. in height, which are spaced, from Brakpan to Simmerpan, at 164 ft. intervals, but on the extension from Simmerpan to the West Rand will be placed 492 ft. apart. It will thus be apparent that the whole of the transmission line, with masts, is in duplicate, the object being to ensure continuity of supply. In the case of isolated mines along the Rand, conductors from both lines are introduced, and in the event of the supply failing on one line the switches are automatically transferred to the other supply. Each mast, in addition to the conductors, carries a 12-core pilot and telephone cable and three steel guard wires placed above all the circuits for purposes of protection against lightning. Horn lightning arresters, four in series, and two series in parallel, are placed on each lead on all the conductors, and at all roads and crossings a steel guard net is erected under the conductors to catch them in the event of breakage. At a distance of about six miles from Brakpan there is a large substation, the purpose of which is to control the potential of the line. At this place transformers are installed for reducing the e.m.f. from 40,000 volts to 10,600 volts. It is estimated that about 90,000,000 kw-hours per annum are now being sold, and owing to the demand having been increased it has become necessary to erect large additional stations. The engineers have investigated the suitability of sites at Rosherville and Vereeniging and have advised the company to put five 9000-kw turbo-generators and four 4000-hp turbo air compressors at the former place, and additional plant at Vereeniging, directly the rights-of-way have been granted by the Government. The engineers estimate that in 18 months' time the company will be producing 300,000,000 to 400,000,000 kw-hours per annum for the supply of contracts already secured. Part of this energy is to be delivered in the form of compressed air, and it is therefore proposed to erect compressor stations in the neighborhood of the Eckstein mines, where contracts have been obtained for supply beginning in October, 1910. At the present moment six electric air-compressor units, each of 4000 hp, are being constructed, but it is expected that 8 or 10 of such units will ultimately have to be installed. The price now being charged for energy is 1.5 cents per kw-hour, but in 18 months' time it may be reduced to 1.2 cents.

The main design of the stations at Brakpan and Simmerpan has been prepared by Prof. G. Klingenberg, of Berlin, working in conjunction with the engineers-in-chief, Sir. Douglas Fox and Partners, and Mr. Arthur Wright.

## Large Power Plant for Boston Elevated.

The announcement has been confirmed in Boston of the purchase by the Boston Elevated Railway Company of a 25-acre tract of land in South Boston to be the site of a large generating station of the alternating-current type, which will ultimately supersede all or nearly all of the scattered plants which have for many years generated and distributed direct current at from 575 volts to 600 volts for the operation of the surface, elevated and subway lines of the system. Many of these separate stations have displayed excellent efficiency in their individual operation; but there is little question that broad opportunities for increasing the economy of production and distribution of power await the centralization of the steam and electrical system. The company's annual cost of electric motive power for the fiscal year 1908 was $1,641,902, or approximately 3.2 cents per car-mile. Over 409 miles of track are operated by the company. The site of the new power plant is adjacent to that of the L Street station of the Edison Electric Illuminating Company, of Boston, which supplies power from a central generating station on the water's edge through a territory of 500 square miles surrounding the Boston district. The location will permit the highest efficiency in the handling of fuel and the use of the water of Boston Harbor for condensing purposes. An initial step in the remodelling of the Boston Elevated power system is now under way in the construction of a rotary converter substation in the Forest Hills district, to be operated from the Dorchester plant of the company.

## Electrical Engineering Staff of Cornell University.

As newly organized, the electrical engineering staff of Cornell University consists of sixteen members, as follows: Henry H. Norris, professor in charge of department; Vladimir Karapetoff, professor; assistant professors, George S. Macomber and Walter S. Ford; instructors, Boyd C. Dennison, Anson M. Holcomb, Fred H. Kroger, Alexander D. DuBois, Frank G. Anderson, John F. H. Douglas, Irving C. Pettit, William E. Hogan, Frank G. Tappan, Evan J. MacIlraith, Arden B. Holcomb; assistant instructor, John G. Pertsch.

Professor Norris during the present year officially took charge of the department as successor to Professor Ryan, who resigned in 1905. This fall there was transferred to the department the

CORNELL'S ENGINEERING STAFF.

electrical laboratory, which was administered up to 1905 by the department of physics. Since then it has been under the charge of the experimental engineering department of Sibley College. The work of the electrical department has been divided into three sections, as follows: (a) Introductory courses, in charge of Prof. G. S. Macomber; (b) advance theoretical courses, in charge of Prof. V. Karapetoff; (c) advance laboratory courses in charge of Prof. W. S. Ford. Each professor is assisted by a number of instructors, including one of a new grade established this year, which grade is filled by men of substantially the same training as assistant professor, being intermediate between an instructorship and a professorship. The intention is to devote the main strength of the department to instruction in the fundamental theory of electrical engineering. Some elective courses are offered, but they are merely designed to show the application of the fundamental principles. This year there are over 90 seniors in electrical engineering.

## Rough Treatment of High-Tension Cables.

The operating department of the Commonwealth Edison Company of Chicago reports a remarkable case of the durability of high-tension, lead-covered cables under rough treatment. In the early part of December a 36-in. water main, located at Thirty-fifth Street and Lowe Avenue, in Chicago, burst, allowing such a deluge to escape as to flood the street for a quarter of a mile each side of the break and washing out a hole in the street about 15 ft. in diameter by 12 ft. deep. The conduit line of the Commonwealth Edison Company was within 2 ft. of this main. This conduit consisted of tile single duct embedded in concrete. The water continued to gush out of the break for a number of hours. The concrete was literally washed off of the tile duct and the duct was broken in short pieces so that it was strung along the high-tension cable like a string of beads. There were three 9000-volt, three-phase cables alive in these ducts. The Commonwealth Edison Company knew nothing of the break until the water had been running for several hours, as the cable maintained its insulation. The whipping about of the water stretched the cable somewhat, but it was found to test out in good condition as to insulation, and after being tied up at one side of the pit so that the water main repairs could proceed the cables were again put in service, with a man at the washout to see that no one damaged them mechanically, as they were exposed. The break in the mains occurred early in the morning and the company knew nothing of it until afternoon. About three-fourths of the original tile of the duct was still on the cable. The stretch will be taken out by pulling up the slack at the nearest manholes when the conduit is relaid.

## India Rubber Importations.

The Department of Commerce and Labor in a report issued states that the importations of india rubber into the United States in the year about to end will exceed in both quantity and value those of any earlier year. During the 10 months ending with October, 1909, the importations of india rubber (including "balata," gutta-percha and "gutta-joolatong") reached the record total of $62,000,000, exceeding by over $6,000,000 the total for the entire calendar year, 1906, the banner year in this import trade. For the single month of October the imports of india rubber were valued at over $8,000,000, and should this rate be maintained during November and December, the total for the 12 months ending with December, 1909, would be over $75,000,000 as against $46,500,000 in 1908, $54,000,000 in 1907 and $56,000,000 in 1906.

The growth in demand for india rubber, measured by the increase in importations, has been a marked feature of the last 20 years, and few if any of the raw materials for which the United States is dependent upon foreign countries for its supply show a growth as rapid as that of india rubber importations, the increase being from $12,500,000 in 1889 to $46,500,000 in 1908, with every indication that the total for the year just drawing to a close will exceed $75,000,000.

This increase in the value of india rubber imported is due in part to the advance in price following the enlarged demand in various parts of the world, and especially in the United States, which consumes fully one-half of the world's output of india rubber. Thus, while the quantity of india rubber imported has increased from 32,000,000 lb. in 1889 to 55,000,000 lb. in 1899 and 73,000,000 lb. in the 10 months of 1909 for which figures are available, the average import price has advanced from 39 cents per pound in 1889 to 60 cents per pound in 1899 and 80 cents per pound in the elapsed months of the present year, while for the single month of October the average import price was practically $1.00 per pound.

The import price of the crude rubber brought into the United States during the 10 months for which figures are available has exceeded that in any earlier year, having averaged 80 cents per pound in the period in question, while the highest annual average in earlier years was 78 cents per pound in the fiscal year 1906, 76.6 cents per pound in 1907 and 74.2 cents per pound in 1905, the import prices prior to that time ranging from 68 cents per pound in 1904 down to as low as an average of 38 cents per pound in 1889.

Of the $62,000,000 representing the importation of the various classes of india rubber in the 10 months of 1909 for which detailed statistics have been completed by the Bureau of Statistics of the Department of Commerce and Labor, $58,500,000 represented india rubber proper; $2,000,000 scrap rubber, fit only for manufacture; $1,000,000 gutta-joolatong, an article similar to and mixed with rubber for use in various industries; $357,000 balata, and $123,000 gutta-percha.

Brazil is the chief contributor to the india rubber supply of the United States, the quantity imported from that country in the 10 months ending with October amounting to 34,000,000 lb., valued at $30,500,000, while the United Kingdom contributed, presumably from its African and East Indian colonies, 9,000,000 lb., valued at $10,500,000; Mexico, 15,000,000 lb., valued at $5,500,000; Germany, 4,333,333 lb. valued at $3,500,000; other Europe, 6,666,666 lb., valued at practically $6,000,000, while from the East Indies direct there was a total importation of a little over 1,000,000 lb., and from Central America slightly less than 1,000,000 lb.

The relation of india rubber importations to domestic manufactures in which that article is used as a raw material is apparent by reference to census figures, which show that the number of establishments engaged in manufacture of rubber and elastic goods has increased from 93 in 1880 to 224 in 1905; the capital employed from $6,000,000 to $46,000,000; the wages paid from $2,500,000 to nearly $9,500,000, and the value of the product from $14,500,000 in 1880 to $63,000,000 in 1905. Meantime, exportations of india rubber manufactures are assuming important proportions. In the calendar year 1889 they were valued at $937,497; in 1899, $2,081,588, and in the 10 months of 1909, $7,067,038, indicating a total of over $8,000,000 for the calendar year. Of the $7,000,000 worth of india rubber manufactures exported during the 10 months, boots and shoes were valued at $1,250,000; belting, hose and packing, $1,500,000, and $4,000,000 miscellaneous.

## Suburban Electric Extensions Around Chicago.

Zion City, widely known as the headquarters of the religio-sociological enterprises of the late John Alexander Dowie, will be supplied with electricity by the North Shore Electric Company, of Chicago. In Dr. Dowie's time there was built an electric generating plant at this place, and the North Shore company has bought the distribution system from the receiver of the Dowie enterprises. The generating plant will be shut down and sold. It was a steam-operated plant, and supplied both alternating current and direct current. Zion City will be supplied with electricity by the central-station company direct from Waukegan, six miles distant. The transmission will be at 2300-4000 volts, three-phase, and the electrical energy will be used for both lighting and power.

The North Shore Electric Company is building a new transformer substation in Lake Bluff, a northern suburb of Chicago. The building is of brick and fireproof, and will provide a high-tension switching center. It is laid out for an ultimate capacity of 1500 kw, but the initial installment of transformers will be about 400 kw. The arrangement is such that one section will be built complete at first, and others may be added as needed.

Another extension of the North Shore company's service is to the village of Deerfield, about four miles west of Highland Park, another northern suburb of Chicago. The 40-watt series tunsten lamps will be used for street lighting, and commercial service also will be given. The same company is building an extension to Rockefeller, now called Area, two miles west of Libertyville. Commercial electric service will be available here.

A street-lighting contract has been entered into with the vil-

lage of Edison Park, near Chicago, by the North Shore Electric Company. Series tungsten lamps will be used, and the electricity will be supplied from the Park Ridge substation.

Commercial service has been extended into the villages of Niles Center and Niles, which are about six and seven miles west of Evanston.

## Hydroelectric Plants.

At the meeting of the American Institute of Electrical Engineers, held on Dec. 16, Mr. Henry L. Doherty presented a paper containing comments on the development and operation of hydroelectric plants. He claimed that compared with almost every other class of investment, a water-power plant is far preferable. As a step toward the conservation of our national resources, the Government should remove as far as possible every unnecessary obstacle to water-power development.

A confused condition exists in the popular mind in regard to the marketing of energy. The inability of the public to understand this matter has been a great obstacle in the development of hydroelectric propositions—and in this matter the electrical engineering fraternity has been more or less to blame. Cost of energy is sometimes figured and stated on a kw-hour basis, and at other times on the basis of peak load, or what might be termed an equipment basis. Without knowledge of load-factor, or simultaneous demand-factor, figures stated in these different ways may prove so misleading as to bring about expectations of returns varying all the way from $8 to $300 per horse-power of station equipment. This confusion has played no small part in the mistakes which have been made; these mistakes have caused the investing public to mistrust their ability to make correct deductions.

The problem of reliable service from long transmission lines is much further from solution than all of the other problems that have done so much to contribute obstacles to rapid development. Good engineering talent and other proper precautions will insure that the cost of construction shall be no greater than that promised. One can also accurately determine the available power, and can insure against disappointments in market. The best of engineering talent does not seem, however, able to promise for a transmission line the same continuity of operation that can be secured from a steam plant located at the point where the energy is to be used, and this condition introduces many serious obstacles to the development of water-power projects. The importance of continuity of service varies in degree with almost every customer served. To some industries a mishap which causes even a fall in voltage or a change in frequency may be a serious matter.

In order to insure continuity of service, it has been suggested recently, in connection with two hydroelectric plants to be erected, to install a steam turbine auxiliary, the generator of the turbine being run normally as a motor and the governor being so arranged as to admit steam to the turbine in case the speed of the water-wheels decreased perceptibly. As a standby steaming equipment the internally fired boiler deserves careful consideration. This boiler is subjected to a small radiation loss, and is able to maintain tightness against ventilation when the fires are banked.

In all electrical undertakings the question of depreciation is one which has an important bearing. Practically all of the present assumptions for depreciation are too high. Figures applied to depreciation are used in a general sense without regard to what the plant consists of. The character of construction will largely influence the rate of depreciation. It is manifest that a plant having 10 per cent of its investment in wooden poles and 20 per cent of its investment in a masonry dam will have a higher rate of depreciation than the plant which has only 2 per cent of its entire investment in wooden poles and over 50 per cent of its entire investment in a masonry dam. Each individual class of property should be given its own true rate of depreciation, if any depreciation at all is to be figured, or else the different parts of the plant having the same relative rate of depreciation must be grouped together in figuring what the total depreciation will amount to on the entire property.

The price to be charged for service evidently depends largely upon the load factor of the customer's installation. No general and complete rules can be laid down whereby the maximum load factor can be secured to a hydroelectric company. Rational methods of charging, properly explained so they can be understood both by consumers and by prospective consumers, will do much to contribute to a good load factor.

Mr. Doherty expressed the opinion that the future situation in the hydroelectric supply business will eventually be that of the market greatly exceeding the supply, and the natural remedy will be the installation of steam plants by the hydroelectric companies to enable all possible available water to be used. Central-station steam-power plants have been made a success in competition with individual steam plants, and the success of steam plants in connection with hydroelectric plants should be even more pronounced.

### DISCUSSION.

Mr. H. G. Stott discussed the use of a steam plant as a reserve equipment for a hydroelectric plant, and expressed the opinion that for this purpose the steam turbine is better adapted than the reciprocating engine. He showed curves of station loads as illustrating the variation in the most economical percentages of steam and hydraulic power. In one case, the best ratio was found to be 60 per cent hydraulic with 40 per cent steam in winter, and 40 per cent hydraulic with 60 per cent steam in summer.

Mr. S. E. Doane remarked that one of the fundamental reasons for the slow development of a market for the energy from hydroelectric plants has been the lack of information on the part of the public as to the cost of service. Illogical and unjust methods of charging have served to retard greatly the fullest and most complete utilization of the capital invested in electric service securities.

Dr. Cary T. Hutchinson discussed in detail the depreciation of the several parts of a hydroelectric installation. He stated that of the total cost of a hydroelectric generating and transmission plant 20 per cent is necessary to cover the expenses preliminary to actual construction, the buildings and hydraulic construction represent 30 per cent, the equipment of the power house 14 per cent, the transmission system 13 per cent, engineering 11 per cent and interest during construction 12 per cent. Of the six items specified the first and last two are not subject to depreciation, while the other three have an annual depreciation equivalent to 1.041 per cent of the total cost.

Mr. Harold W. Buck said that people in general have a very false idea as to the commercial value of waterfalls. The Government has adopted a discriminating attitude against water-powers as distinguished from other natural resources, such as timber lands, mines and farm lands. The Institute can do much toward correcting the wrong impressions that have been formed.

Mr. John Martin thought that the Government should not charge for the use of water, but should fix a maximum rate to be charged for energy derived from hydroelectric developments. He described the "load-despatching" system of the Pacific Gas & Electric Company, which is so arranged that one man has entire charge of the operation of its 600 miles of high-voltage transmission lines. Use is made of a dummy board for showing the exact condition of each line and switch throughout the whole system at each instant.

Mr. W. N. Ryerson claimed that long-distance transmission lines in general are unreliable and should not be depended upon exclusively when continuity of service is expected.

Mr. Julian C. Smith gave a tabulation of the interruptions during seven years to the 50,000-volt transmission equipment of the Shawinigan Water & Power Company, which operates a 100-mile system over two separate pole lines. The energy is received through synchronous motor sets. Of the interruptions 27 per cent were due to the transmission line, 21 per cent to lightning, 11 per cent at the substations, 24 per cent at the power house, 13 per cent at the terminal stations and 4 per cent

unknown. Of the whole number of interruptions 20 per cent were caused by bad construction, 20 per cent by errors of operation, 7 per cent by interference by outsiders, 8 per cent by external extraordinary conditions.

Mr. Calvert Townley gave definite data on the cost of hydroelectric developments under New England conditions and the equivalent steam equipments for the same service, showing that although the operating cost of a hydraulic plant is very much lower than that of a steam plant, its fixed charges are so much higher that it cannot be run in competition therewith unless the load factor is very high.

Mr. D. B. Rushmore called attention to the fact that hydroelectric installations can be made reliable and cited the case of the 100,000-volt equipment of the Great Western Power Company, which has been practically free from line troubles.

Mr. Chas. H. Baker, in a written communication, claimed that the hydroelectric plant at Snoqualmie Falls, Wash., has no equal from any point of view in the shape of any steam plant in operation upon the Pacific Coast. This plant operates continuously with scarcely a second of interruption per year. This fact is attributable to absence of a flume, simplicity of wiring and to the use of a duplicate transmission line following a right-of-way cleared of all trees and other features which might affect the continuity of the service.

## "Wireless" Discussed at Armour Institute.

At the regular meeting of the Armour Institute of Technology branch of the American Institute of Electrical Engineers in Chicago, on Dec. 16, much interest was shown in a paper presented by Prof. G. E. Marsh, of the electrical engineering department at Armour. The subject was "Wireless Telegraphy," and in the course of a two-hour talk the theory and fundamental principles involved in the generation and receiving of electric waves were outlined and explained in considerable detail. The structure of the electromagnetic wave as radiated from a vertical aerial was represented diagrammatically. Simple calculations giving the efficiency of this method of telegraphing and the sensitiveness of the modern wireless receiver were worked out, and the results were somewhat surprising to many in the audience.

The ohmic resistance given to high-frequency currents was exhibited by a table. Following this was interesting comment regarding the character of the limiting phenomena accompanying electric oscillations of very high frequency. A few experiments with oscillating currents were shown, as well as the operation of a set of wireless-telegraph sending and receiving instruments.

The talk was a résumé of some of the material which the speaker had presented previously before the regular weekly meetings of the Hertzian Society, a student organization active in the study of wireless telegraphy and telephony. Among the more interesting points dwelt upon in the discussion were the electromagnetic factors involved in the penetration of the outer boundaries of the earth's atmosphere by electric waves and the theoretical possibility of signaling to Mars.

## Peculiar Trouble with Rotary Converters and Its Remedy.

A peculiar trouble has been experienced in the substations of the Chicago City Railway Company in which some 1500-kw and some 2000-kw rotary converters are used. Severe flashing over and arcing from brush-holder rings and commutator bars to bolt heads and grounded parts of the converter frames took place. That this could not be due to causes outside of the substations was demonstrated by the fact that the lightning arresters with very much shorter spark-gaps than the breaks arced over on the converters would not discharge before the breaking over took place on the converters. After attempting for some time to locate the source of trouble as coming from surges or unduly high potentials on the incoming lines it was concluded that the breaking over was due to static potentials caused by the rubbing of the brushes on the large commutators. The inductance of the path between the commutators of the rotary converters and the arresters prevented the static charge from finding its way to earth across the arrester points. The static charge would therefore take the most direct path to earth and the power current would follow it, resulting in tremendous flashes. The trouble has been remedied by the installation of aluminum-cell lightning arresters permanently connected between the positive terminal of each rotary converter and ground. Two 250-volt cells are connected in series between the bus ring of the converter and ground. In shunt with each of these cells is a balancing resistance of 20,000 ohms. It was found that without this resistance in shunt the continuous discharge to the arrester would unbalance the cells so that one might have a counter e.m.f. of 110 volts and the other 440 volts, with the result that the cell with the lower e.m.f. would heat. With the shunt resistances a balance is maintained and with the continuous passage of 0.033-amp dynamic current there is no heating. A small panel for plugging in an ammeter in series with the cells occasionally to determine the flow through the cells to ground is provided. The cells and panel are mounted on a slate shelf in the pit under each converter. In one substation arcing over occurred on an average of once a month. In the period of one year since this substation was equipped with the discharge sets there has been no recurrence of this trouble.

## Chicago Electrical Show to Be a Brilliant Spectacle.

Interesting preparations are under way for the illumination and interior decorations of the Chicago Electrical Show, to be held in the Coliseum on Jan. 15 to 29, inclusive. The lighting scheme is new, elaborate, and should prove beautiful. Springing from the corner posts of each exhibit space will be two low arches meeting above the center of the space. From the point of intersection will be suspended a dome shade 3½ ft. in diameter, which will be made to represent colored art glass. This shade will contain five 100-watt tungsten lamps with Holophane reflectors, and will flood the exhibit with light. The height of the lamps will be about 12 ft. from the floor. In addition the corner posts, which are 9 ft. high, will each support a 60-watt tungsten lamp inclosed in a globe representing art glass. Intermediate between the corner posts will be larger posts about 13 ft. high, and these, too, will be surmounted by globes similarly made, each containing a 150-watt tungsten lamp. In all there will be on the floor in post lights and dome shades about 1200 tungsten lamps of the three sizes mentioned.

Around the balcony will be a frieze of canvas with molded ornaments at intervals of about 30 ft. Each of these ornaments will contain a transparency behind which will be a 16-cp carbon lamp, producing a pleasing effect.

But the greatest novelty of the illumination will be in the upper part of the building. The roof trusses will be concealed by dead-black bunting. At each end of the building, mounted in the galleries, will be three 30-in. searchlight projectors. Hanging from the ceiling will be ribbons of gold and silver tinsel of various lengths, and as these are waving in the air currents of the large interior, they will catch the light from the projectors and reflect it and scintillate it in a way which should make a brilliant spectacle. In this eye-arresting fashion it is proposed to produce an overhead illumination feature which will be a worthy successor of the night-sky effect of a year ago. The projectors will probably be some of those used at the recent Hudson-Fulton celebration in New York.

Suspended from the roof trusses will be the Wright aeroplane recently purchased by the Government from the Wright brothers. Lieutenant Foulois, of the Signal Service of the United States Army, will be in charge of this airship with a number of assistants, and he will place it in position and direct

its exhibition during the period of the show. The aeroplane will be equipped for wireless telegraph or telephone communication, and daily demonstrations will be made. This interesting feature of the show was not secured from the Government without considerable argument, the representative of the Electrical Show at Washington during the negotiations being Mr. Frank L. Perry.

About 90 per cent of the available exhibit space has been sold. There will be no exhibits in the balcony, and here about 3000 chairs are provided, where the weary may sit down to rest and to listen to the music of Weber's Band, which will be in attendance. An effort will be made to increase the attendance at the coming show during the daytime. Judging by the preceding shows, no such effort is necessary for the evening attendance. The Commonwealth Edison Company and the Chicago Telephone Company are sending out to 100,000 and 200,000 customers, respectively, attached to monthly bills, coupons which will be good for half-price admissions if used before 5 p. m. each day. The Commonwealth Edison Company will be in the Annex this year, and its exhibit will consist of a model garage for electric vehicles. Special attention will be paid to electric vehicles, and a number of manufacturers will have exhibits of this character. In addition to its garage, the Edison Company will have a lecture hall, where lectures and demonstrations will be given to show the advantages of various uses of electricity.

During the show there will be a number of "special days" particularly devoted to various electrical societies, such as the Wisconsin Electrical Association, Illuminating Engineering Society, Sons of Jove, American Institute of Electrical Engineers, Electric Club of Chicago, and the Thomson-Houston Association.

Attractive souvenirs will be distributed to paid-admission visitors on Monday, Tuesday and Wednesday of each week. The show is given by the Electrical Trades Exposition Company, of which, as in former years, Mr. Homer E. Niesz is manager.

## St. Louis Electrical League.

The first annual banquet of the League of Electrical Interests of St. Louis was given at the Mercantile Club on the evening of Dec. 16. Capt. Robert McCulloch, president of the league, presided. Among the guests were Mr. T. Commerford Martin, executive secretary of the National Electric Light Association, who was the principal speaker, and Messrs. Henry Kent, H. H. Humphrey, Arthur Scudder, Jeptha Howe, James A. Waterworth, Edward Devoy, L. A. Hobson and Arthur S. Partridge.

Prior to the banquet a short business session was held, at which a constitution and by-laws was adopted, and the following committees appointed:

Questions of Public Interest.—Messrs. George D. Rosenthal, E. J. Pietzcker, A. S. Partridge, R. V. Scudder, Eugene Devine, William Clegg, Jr., H. C. Henley and J. P. Casey. Entertainment.—Messrs. L. M. Sperry, C. J. Sutter, Fred Johnson, J. R. Cullinane and R. J. Russell.

In his address, Mr. Martin declared that the American people to-day are paying twice as much for electrical service as for the bread they consume. The total figures, he said, have reached $1,200,000,000 a year, and probably in excess of that amount. The capital obligations in the electrical field are over $8,000,000,000. The farmers of the United States virtually earned that amount in 1908 for services rendered in crops. It may be put roughly as not far short of half the railroad capitalization of the country. This amount of stocks and bonds does not, however, include floating debt, a large part of which is incurred for new material, etc., and no one knows just what that is, additional. Moreover, this vast sum does not include the growing investments of the steam railroads in electrical equipment, nor the value of any of the 100,000 isolated plants in mines, factories, hotels, office buildings, country residences, etc. The point insisted upon is that this sum is not inert, but is very much alive, and that in maintaining it as active capital and in giving service, principally in public utilities, the electrical field affords one very clear definition of its purchasing power. That $8,000,000,000 is and must be reproductive, and can only be so by the incessant replenishment of apparatus and supplies. The capital liabilities of the electric railway field alone show a total of not less than $4,000,000,000, the data being furnished by the 1300 companies included. The increase during the year was over $350,000,000, most of which was new capital poured into the industry.

A more direct and less inferential way of envisaging the purchasing power of the field is to consider the earnings, said Mr. Martin, regardless of the investments. It may be stated without any fear of contradiction that the total annual expenditure on electrical appliances, current and service in the United States has reached the sum of about $1,200,000,000 and is probably much in excess of that amount. The data from which such a result may be reached are in sight, and may be gaged by anyone willing to take the trouble. Authentic census figures, which Mr. Martin compiled for the Government, for 1905-06, show that electrical manufacturing reached in that year the figure of $140,000,000 as the product of 784 establishments. But this does not include any wooden, iron or steel poles; it did not include a large quantity of glass and porcelain made only for electrical purposes. It omitted bare iron and copper wire. It did not reckon in the electric automobile. It excluded the whole group of electrochemical and electrometallurgical products, these all being technically in other branches of manufacture, but it is obvious that much comes naturally into the electrical scheme. Hence the product for 1906-08 may be put at $175,000,000. The average rate of increase in electrical goods for nearly two decades has been over 15 per cent per annum and in the great year of 1906 the gain was over 30 per cent. On such basis even a dull year like 1908 would reach $250,000,000 and 1909 might far overlap that mark.

## Episodes in the Early Career of Edison.

A dinner was given to Mr. Thomas A. Edison, on Dec. 20, at the Plaza Hotel, New York, by representatives of moving-picture companies, at which Mr. Edison, in accepting a handsome trophy in silver, gave some reminiscences of first experiences in New York City around 1874, and particularly with respect to his abilities then as a financier.

One day he went from Newark to Wall Street with a faint hope of being able to market his first invention of the duplex system in telegraphy. He knew nothing of Wall Street or its methods, but he had the acquaintance of General Eckert, of the Seventh Regiment, then at the head of the ticker service, in the days when there was plenty of excitement in the gold market.

The General did not see his way to do anything with the duplex patents and Edison, disconsolate, was waiting around to see the General again when the ticker broke down. Consternation prevailed in the office and presently brokers came rushing in to find out why they did not receive the quotations. General Eckert was as much distressed as anybody else, but pretty soon Edison, who had been studying the mechanism, told the General that he thought he could fix it so that it would work again. Eckert told him to go ahead and try. Edison succeeded, to the immense relief of the General and the local community.

Next day General Eckert sent for Edison and told him that he thought the company could employ him and offered him $400 a month, a sum that staggered the inventor, as the largest pay he had received up to that time had been $100 a month. The stagger was the greater because he had felt himself down and out. While in the employ of this company Edison set himself to perfecting details in its mechanical instruments in connection with the other studies in the line of practical invention, and the next he knew General Eckert sent for him and wanted to buy his patents in telegraphy. Edison felt stumped, for he had no idea what value to set upon his inventions. He also had a wholesome dread of Wall Street, knowing it only by reputation.

He had never even had a bank check, nor had he ever been

inside a bank. He went home and spent the night awake thinking the matter over and finally arrived at the conclusion that the most he dared ask for his patents was $5,000. When he went back to see General Eckert the next day he did not dare speak this figure aloud, and when General Eckert asked him what he had decided on he was silent, trying to screw his courage up. General Eckert finally broke the silence and offered him $40,000.

Staggered, Edison pulled himself together as soon as he could and agreed that he thought that would be a fair amount for his patents. Eckert prepared a contract for him to sign, and he was so agitated that he signed it without even reading it. The General presently gave him a check for $40,000, and Edison, not having seen a check before, or at least not having had occasion to use one or see one used, did not even know what to do with it. He even thought that he had been buncoed, receiving a piece of paper for all his work.

He asked General Eckert what to do, and the General advised him to go to a bank with it and open an account. Edison went to the bank and did not even know what window to go to, but finally went to one where his piece of paper was accepted and taken away. As nothing was said to him he presently departed, sure this time that Wall Street had buncoed him, and wended his way back to his friend the General, who smiled and sent him back to the bank.

Edison was now awfully sore, as he said, and he was perspiring freely, although the thermometer recorded 5 deg. below zero. Back at the bank they laughed at him, but the president came out and asked him how he wanted his money. He responded in any way that was convenient to the bank, and they gave it to him, the whole $40,000, in small bills, which Edison took home in bulging pockets, only to sit up all night with it in his anxiety.

Then on advice he went back to the bank and opened an account.

"And," said he, "I bought a lot of machinery that I thought I wanted, and in six weeks I was down and out again without a cent. That's the kind of a financier I was in those days."

## Massachusetts Commission News.

The Massachusetts Gas and Electric Light Commission has authorized the East Boston Gas Company to issue 12,000 shares of stock for the purpose of exchange for the outstanding stock of the Chelsea Gas Light Company, the two companies having signed an agreement of consolidation. The board has also dismissed without prejudice the petitions of patrons of both companies asking for a reduction in the rates charged for gas, stating that the consolidated company should first be permitted to demonstrate whether the reduced price asked is reasonable. The price is to be 90 cents net per 1000 cu. ft. after Jan. 1, 1910. The relations of the new company with the engineering and executive administration of the Boston Consolidated Gas Company are to be close, and it is expected that the benefits of the consolidation may ultimately permit the same prices in East Boston and Chelsea as in the city proper.

The commission recently gave a hearing upon the petition of the Athol Gas & Electric Company for approval of an issue of capital stock to the amount of $170,000. The company was represented by its counsel, Mr. Edward C. Mason, of Boston, and considerable testimony of commercial and engineering interests developed in connection with an explanation of the company's plans for extending its service in the Athol and Orange district.

Mr. Mason stated that the entire stock interests of the central-station companies in Orange and Athol were purchased in the spring of 1909 by Mr. W. G. Webber, of Boston, president of the Athol Gas & Electric Company. It was then apparent that in these towns there was a possibility of the development of a considerable amount of cheap power for manufacturing and other purposes. Each of the companies was too small by itself to accomplish the development, not being in a position to incur the expense nor having the necessary credit The companies were merged for the reason that in combination they would furnish the required credit for developing a motor-load and putting the electrical service of the two towns on an economical basis.

The value of the Orange property purchased was listed at its present value, no allowance being made for good-will or for the value of the going business. It was found that the demand for motor service in the territory was greater than was estimated. In Orange and Athol at present there are plants and factories using steam power alone aggregating 4364 hp. With the development now under way at the Wendell station 1000 kw can be produced by water-power in two 400-kw and one 200-kw units. The demand for motor and lamp service in Athol and Orange has been unprecedented. Since the company has been working in the territory it has made no effort to increase the load, on account of lack of equipment, but despite this it has recently been obliged to take on 130 hp in the two towns. A 650-hp steam plant will have to be installed at the Wendell station as a reserve in case of accident. It will also be necessary to construct circuits for motors in both Athol and Orange in order that the lighting service may not be interfered with.

The Athol company desires to issue stock to cover the following improvements: Retire bonds, $50,000; 100,000 cu. ft. double-lift gas holder, $10,203.85; extension of gas mains, $4,000; additional 400-kw motor-service unit, $14,665; additional 650-hp steam plant, $20,400; new power and street-lighting lines, Orange, $19,598.75; meters for Orange, $6,189.31; transformers, Orange, $7,417; lines, Orange, $19,229.24; miscellaneous, $1,609.17; total, $153,312.32. These items were explained to the board and the hearing was closed.

## Cost of Generating Electric Power.

The cost of power and general considerations bearing upon its production were informally discussed at a recent meeting of the Boston Society of Civil Engineers by Mr. Charles T. Main, consulting engineer, Boston, and Mr. F. M. Gunby. The conditions in the textile industry were the principal theme of the authors, who emphasized the importance of saving money by the use of receiver steam and the water of condensation in mills where the manufacturing process is based upon the production of colored goods. Where the so-called waste products of a steam plant can be used in the mill the cost of power is a minimum, if figured net. The opportunities for very low-cost power production are much less favorable with mills making simple white goods, and here the hydroelectric company or the central station stands a better chance of securing the business. Thus, in the case of a colored textile mill an offer of power at 1.2 cents per kw-hour was refused by the mill owner's engineers, since the cost of power was figured at a lower rate in the mill plant through the use of receiver steam for manufacturing purposes and the water of condensation for dyeing. The cost of power offered by the hydroelectric company was close to the best figure that the mill could produce, but even if the power had been taken from the transmission system it would have been necessary for the mill to install nearly as costly a boiler plant as though no hydroelectric power were available. This plant would have to be operated to furnish steam for manufacturing, and hence the use of outside service was not considered advisable. In a second textile plant, however, which made white goods only, the engineers recommended the taking of the hydroelectric power at the 1.2-cent rate, and not only was this practically the figure at which it was estimated that the mill could generate power, but the existence of the hydroelectric service saved the mill from a heavy investment in steam plant equipment.

A general discussion of the power question was included in the paper, and in this connection the evil effects of a poor load factor were briefly reviewed. The authors also considered the bearing of development cost on the success of hydroelectric power projects. It was stated that water-power plants are usually characterized by high fixed charge accounts and low operating expenses, and also that the reliability factor may have

an important bearing on a water-power privilege. Generally a water power tends to have a rather low factor of reliability, due to the fact that there is usually only one dam, one power house, and often a long transmission line, besides risks from floods and droughts. It is most important to avoid excessive fixed charges in water-power work. The neglect of incidental costs often leads to trouble. There is an idea commonly held that if a development will cost $100 per hp, it will be a safe investment, but when it reaches $200 per hp it is well to proceed with caution. There are sometimes occasional markets, notably in mines and remote places, where power costs are high, where it will pay to undertake a project even in the face of a high development cost.

The authors estimated that power could be produced in a 2000-kw textile plant with coal at $4.75 per long ton as follows, including fixed charges:

(*a*) Equipment, reciprocating engines and direct-connected generators, first cost of plant, $125 per kw. Cost of power, 3000 hours, $32 per kw per year, or 1.065 cents per kw-hour. For 24-hour-per-day power the production cost would be $57 per kw-year, or 0.792 cent per kw-hour.

(*b*) Equipment, steam turbine sets; first cost of plant, $100 per kw. Cost of power, $29 per kw-year, or 0.965 cent per kw-hour. For 24-hour power the yearly cost would be $52 per kw, or 0.734 cent per kw-hour.

In this estimate interest was assumed at 5 per cent; depreciation and repairs on equipment, 4 per cent; depreciation and repairs on buildings, 2.5 per cent; insurance and taxes, 1 per cent; total, 10 per cent on the equipment and 8.5 per cent on the building. It was stated that higher rates of depreciation would have to be allowed on a public-utility plant on account of the advances in the art, which would necessitate the discarding of apparatus in good mechanical condition in favor of more efficient units. It was also shown that the steam turbine does not lend itself as flexibly to the use of steam for manufacturing purposes as does the reciprocating engine. The authors hope to investigate this question in the future.

Referring to the cost of water-power, the authors said that by some it is believed that if a plant will cost $100 per hp for the development, if carried to its most economical point, it will be a safe investment, but when it reaches $200 per hp it will be well to proceed cautiously before investing any money in it. But, it was added, there are sometimes exceptional markets, for example, in mines and other remote places where power costs are high and where high prices can be obtained. Under such conditions a large cost for development is warranted. For example, there is one development in Mexico for which the authors were consulting engineers where the cost of power at the mines was from $150 to $200 a year, gold. A hydroelectric development was made and power delivered at $100 per hp, thus making a great reduction in cost to the mine owners and yielding a substantial profit to the electric company. Another case is a plant in California which cost about $400 per hp to develop. A small portion of this power could be disposed of at the mines for $75 per hp with comparatively short transmission lines, but the remainder had to be carried a long distance and sold in competition with other power. The fixed charges alone on this development were at least $30 to $35 a year, and the running expenses were also high. It was impossible to produce power cheaply enough to compete with other sources of powers and pay the fixed charges on the investment.

## Canadian Hydroelectric Commission News.

The town council of Toronto, by a vote of 7 to 2, has decided to submit to a vote of the ratepayers at the municipal elections in January a by-law providing for the issue of debentures to the amount of $30,000 for the cost of a plant to distribute throughout the town electric power to be supplied to the town corporation by the Hydroelectric Commission from the transmission line now being constructed from Niagara Falls to London.

The opposition to the operations of the Hydroelectric Commission by means of recourse to the courts of justice is gradually being disposed of. On Dec. 16 the Division Court, sitting at Toronto, rendered judgment in the case of "Smith versus the city corporation of London," on the appeal by the plaintiff from the judgment of Mr. Justice Riddell of May 4, 1909. In this action the plaintiff, a ratepayer of London, Ontario, sought to restrain the municipality from entering into a contract with the Hydroelectric Commission for power for civic purposes. The effect of the present judgment is a decision that the whole ground of attack by the plaintiff has since been taken away by the legislation legalizing the contract and by-law.

Judgment was also rendered in the action brought by Walter D. Beardmore against the city corporation of Toronto, recently referred to in these columns. The learned justices stated that this action was practically identical with the Smith vs. London litigation and directed judgment to be entered accordingly.

The efforts of interests opposed to the power policy of the Ontario Government to have the Dominion Government intervene and disallow the hydroelectric legislation enacted by the Government of Sir James Whitney have been met with a very spirited reply by the Attorney-General of Ontario. It will be remembered from items appearing in these columns that very persistent efforts have been put forth to cause the Dominion Government to disallow the legislation on various grounds, chief among them being that such legislation was illegal, arbitrary and unconstitutional, and that it prejudicially affected the investment of capital in electric light and power corporations carrying on business within the territory to be covered by the operations of the Hydroelectric Commission.

The reply of the Ontorio Attorney-General, which was made to the Dominion Government on Dec. 7, and has since been made public, goes very exhaustively into the whole question, and after a very comprehensive recital of the important features connected with the formation and operation of the commission, the act creating the commission and providing for the transmission of electric power to municipalities is declared to be "not altogether illegal or unconstitutional, nor is it illegal or unconstitutional in part, being, in fact, both legal and constitutional; nor does it clash with the legislation of the Dominion Parliament; nor does it affect the interests of the Dominion generally."

The Dominion Government has until April next in which to take action on the request for disallowance. It is thought that the request will not be entertained, but that a reference may be made to the Supreme Court on the constitutional question involved.

## New York Public Service Commission News.

At the first meeting held by the Public Service Commission of the First District of New York upon the second plan of reorganization proposed by the bondholders' committee of the Third Avenue Railroad, Mr. John M. Bowers, counsel for the committee, stated that the position of his clients would be to deny the authority of the commission to interfere with the plan. He said that, in view of the recent decision in the Delaware & Hudson case, it was his opinion that the commission had no power with respect to the reorganization plan except to see that the capitalization is not inflated over the existing capitalization, that the properties are properly in the hands of the organizers and that the capital issues, which it is proposed to replace by new securities, were originally properly authorized and made. When the commission rejected the first plan of reorganization offered by the bondholders' committee it laid down several propositions that are hostile to the provisions of the plan that is now under consideration. Mr. Bowers's announcement, therefore, is taken to mean that his clients are prepared to fight in court the rights of the commission to interfere with the present plan.

The Public Service Commission is dissatisfied with the tardiness of the Interborough Rapid Transit Company in equipping

its subway trains with side doors. It is claimed that the promises which were made last summer by the company have not been lived up to, and that by this time all of the express trains should have been fitted with side doors. As a matter of fact, only few such trains are in operation. The commission has decided to take steps immediately to enforce the carrying out of the original order, and is also considering the advisability of ordering the company to provide side-door trains on the express lines during the entire day, and an order directing the company to use side doors on the local trains as well.

The commission also last week adopted two orders calling for hearings to determine whether the Long Island Railroad Company should not be directed to provide station platforms as long as its trains on all lines operated by electricity, and also whether or not the company should be directed to provide the cars of its electric trains with platforms, gates, side doors, vestibule doors and trap platforms to be used to bridge the gap between the cars and station platform. These hearings will begin Dec. 29.

In the matter of the application of the Kings County Electric Light & Power Company before the Public Service Commission of the First District for permission to issue $5,000,000 of convertible debenture bonds, which has been under consideration for some weeks, permission was given the company to withdraw the original application and to submit an amended one. According to the amended application, the company will ask permission to issue $2,500,000 of construction bonds and $2,500,000 of reimbursement bonds. It is understood that the commission will approve the issue of the construction bonds, but there is a question as to whether it has a right to approve an issue of bonds to reimburse the company for work that has already been done. The matter will be considered at further hearings.

The New York City Interborough Railway Company has applied to the Public Service Commission for permission to abandon about three miles of disconnected rails in the Borough of the Bronx. It is stated that the Board of Estimate has already approved this move. These lines, it is claimed, are no longer necessary on account of new lines covering the same territory.

Application has been made to the Public Service Commission by representatives of the United Tax Payers' Association of Queens Borough, an organization composed of 27 civic associations, for permission to construct a new rapid-transit system in that borough, under the provision of the law which provides for the building of such lines at the expense of the property owners benefited. The system favored by the association provides for two main lines leading from Manhattan. One of these crosses the Queensboro Bridge, runs through Jackson Avenue on an elevated structure to Flushing, College Point and Whitestone. The other starts from the eastern terminal of the Williamsburg Bridge and runs through various streets in the direction of Jamaica, Elmhurst and other points in Queens.

The application of the Geneva & Auburn Railway Company for consent to issue $50,000 of 6 per cent cumulative preferred stock will be heard next week by the Public Service Commission of the Second District, and also the application of the Orange County Lighting Company for authority to issue a second mortgage for $200,000 and to issue at present $85,000 in convertible bonds and for authority to issue capital stock for the conversion; also the application of the Mineville Light, Heat & Power Company for authority to exercise franchises in the town of Moriah, Essex County, and to issue $10,000 of capital stock.

The Kingston Consolidated Railway Company has been authorized to issue a second mortgage on its property and franchises to secure an issue of $250,000 in 5 per cent 30-year bonds, and presently to issue $56,000 in bonds, to net the company not less than 80 per cent of the par value. It may also issue its corporate notes in the sum of $17,360, the proceeds to be realized from the sale of bonds and notes to be used to reconstruct its railroad property on Broadway, North Main Street, Wall Street and Main Street in the city of Kingston, and for the paving of that portion of the above-named streets occupied by the railroad. Whatever sum is realized from the salvage of plant or property replaced in the course of above construction shall be used in part payment for the new construction.

The commission has authorized the Auburn Gas Company to issue 5 per cent 20-year debenture bonds, par value $100,000, the bonds in question to be sold at par. A provision is approved which allows the company to redeem at any time on 60 days' notice such bonds as it may desire at 105 and accrued interest. The sum of $9,000 is to discharge certain obligations of the company, and $91,000 for the extension and improvement of its plant and distributing system.

The commission has authorized the New York, Westchester & Boston Railway and the New York & Portchester Railroad companies by joint agreement to consolidate their capital stock, property and franchises and the capital stock, property and franchises of each of them, and the commission approves of such consolidation, provided that the capital stock of the consolidated company shall not exceed the sum of $5,000,000, and that the final agreement of consolidation will be submitted to the commission for approval and for final execution. The corporation to be formed by the consolidation is authorized to abandon such portion of the routes of the consolidated corporations as are not necessary to form one continuous route from the Harlem River in the city of New York to the village of Portchester in the county of Westchester, with a branch line from about 177th Street in the city of New York to Throgg's Neck in said city, and with a branch from the city of Mount Vernon to White Plains, or to the village of Elmsford, in case the application to abandon that portion of the line extending from White Plains to Elmsford should hereafter be denied. The construction of the consolidated railroad as a single railroad is approved and authorized as a public convenience and a necessity.

## Wisconsin State Commission News.

The application of the Cincinnati Construction Company for a certificate of convenience and necessity received a formal hearing before the Wisconsin State Commission on Dec. 15. The petition relates to a proposed electric interurban railway to connect Madison and Janesville, Wis., which will open up a new territory not now covered by the steam roads. Considerable testimony was offered, both by the company and by the citizens of both cities, to show the advantage of such a road, and as no objection to the construction was made the petition will undoubtedly be granted by the commission.

The commission has authorized the Monroe Electric Company to issue 251 shares of common stock of value $100 each and $40,000 par value of 20-year, first-mortgage gold bonds of a denomination of $500 each, to bear interest at the rate of 6 per cent per annum, payable semi-annually. This issue was made in order to allow the newly organized company to acquire the property and holdings of the old Monroe Lighting Company.

The Antigo Electric Company, a newly organized company, has been authorized to issue stock and bonds as follows:

(1) One thousand shares of common stock of the par value of $100 each.

(2) Thirty-five thousand dollars, par value, of bonds of the denomination of $100 and upward each, to bear interest at the rate of 5 per cent per annum and to be secured by first mortgage on all the property of the said company. These bonds are to mature on or before the year 1920. Forty-five thousand dollars of stock is to be issued and delivered to the present owners in exchange for all properties and privileges now owned by them in connection with the electric light plant in the city of Antigo. Fifty-five thousand dollars of stock shall be issued and sold for the purpose of supplying funds for making additions and improvements in the plant. The bonds are to be sold for the purpose of paying all outstanding indebtedness.

### VALUATION OF WATER POWERS.

The hearings that have taken place in connection with the Beloit rate case have emphasized the fact that, for purposes of

rate making, it is absolutely necessary to put some value upon the water rights owned and controlled by hydroelectric companies. Values have been placed on water-powers in cases where those powers were to be sold, or where such power was damaged in any way, but these values, as a rule, are unsatisfactory when it comes to fixing a cost as a basis for an equitable rate. The commission bases its rates for electric power practically entirely upon the question of cost. In testifying on this question before the commission, Prof. D. W. Mead, a consulting hydraulic engineer, gave three bases upon which the value of water-power could be had. In pointing out these methods, he recognized the facts that water-power, like any commodity, has no actual value of itself, as its value depends solely upon the nature of the supply and demand which actually exists or may be created. A water-power at a point inaccessible under present conditions would have no value other than the speculative value dependent upon the possibility of future development and utilization. A water-power, even though utilized, would have a potential value depending upon its location relative to a market and the nature of such a market.

In speaking of the first method of valuing water-power, Professor Mead says: "The value may be measured by the market value of similar water-powers at such locality, provided such market value can be clearly established. Such value should not be measured by the price demanded by parties having a monopoly of such power, nor the price asked by owners having extra power for which they have no use and upon which they wish to realize. An equitable measure of value is usually difficult to apply except when large water-power developments are owned in common by numerous users."

As to the second method, he said: "The value of a water-power may be estimated on the basis of its rental value or the capitalized earnings which may be realized for the use of power under the conditions of its local use. This is a basis more readily applied and more definite and positive in its results."

According to the third method, the value of a water-power may be estimated on the basis of the saving actually effected by its use, compared with the use of such other method of developing power as would be normally used were the water-power not available. "The saving effected should be estimated on the basis of interest, depreciation, repairs, maintenance and operation of both classes of plants considered, and the contingencies and flexibility of service must be given due weight. In such a comparison the capitalized value of the extreme maximum development should not be used, as such a value would, in its practical outcome, ordinarily lead to the adoption of the more common method of power development. The value should be so placed as to make the development of the water-power an object to the plant considered. That is, an actual saving should be entailed by its ultimate use on the basis of the value fixed."

The theoretical horse-power that could be developed at Beloit was estimated by Professor Mead at from 1500 hp to 1675 hp, based upon a 40 per cent load factor, which is equivalent to a 10-hour service. The legitimacy of considering the load factor in the quantitative estimate of water-power depends on the rules governing its use. At Beloit the company is entitled to use its proportion, 40.75 per cent of the flow, no matter whether it uses it in 1 hour or 24 hours, so that the value of its water-power must be estimated on the basis of its load factor. This basis is obviously correct, for it is the basis on which all other portions of its power plant are purchased and installed. The value of the Beloit power should therefore be based on a 10-hour use.

From comparison of similar water-powers in the State, Professor Mead estimated that an entire value of the Beloit power could be fixed at $12.50 per theoretical horse-power as a conservative estimate, which with 1500 theoretical horse-power, would equal an annual rental of $18,750.

Mr. Benezette Williams prepared a very comprehensive report covering the costs of a steam plant of similar size and from his investigations he showed that when all facts were taken into consideration, the saving that could be made effective by the water-power plant would be equal to $17,677 per year, or a value essentially equal to the estimated rental value of the power.

The amounts above fixed as the annual earnings which the plant should make are net and should be capitalized (to ascertain the net value of the water-power) at a rate of interest corresponding to the rate fixed by the commission.

As this is the first case involving the cost of water-power for rate-making purposes the commission has been called upon to decide, it opens up a new question which will have to be definitely settled, as it sets a new precedent in such matters.

## CURRENT NEWS AND NOTES.

*ESTATE OF MILO G. KELLOGG.*—A Probate Court inventory of the estate of the late Milo G. Kellogg, of Chicago, founder and president of the Kellogg Switchboard & Supply Company, shows that the deceased inventor left an estate valued at over $1,000,000. When the debts are deducted it is believed that the estate will be valued at an even million dollars.

*MONTREAL MUNICIPAL PLANT LITIGATION.*—The right of the city corporation to go into the manufacture of electricity for a lighting plant is to be tested in the courts. On Dec. 14 an application was made by C. S. G. Phillips, a prominent member of the Merchants' Association, for an injunction restraining the city from taking a referendum on Dec. 21 on the proposed establishment of a municipal lighting plant. It is claimed that the by-law is illegal and that the taking of a referendum will mean only added expense to the city.

*MEETING OF WIRELESS TELEGRAPH ENGINEERS.*—The regular monthly meeting of the Society of Wireless Telegraph Engineers was held at the factory of E. S. Ritchie & Sons, Brookline, Mass., on Monday, Dec. 6. Mr. Sewall Cabot gave a working demonstration of wireless transmitting apparatus employing a spark gap which consisted of synchronously rotating serial subdivisions. Electrical measurements were made indicating in a general manner the amount of electrical energy in the antenna circuit and the amount of damping in the radiated wave.

*PROPOSED STREET-RAILWAY FRANCHISE DEFEATED IN KANSAS CITY.*—By vote of 11,640 in the affirmative and 18,731 in the negative, the proposition to extend the franchise of the Metropolitan Street Railway Company, of Kansas City, for a period of 26 years from 1925 was defeated at a special election in that city on Dec. 16. The proposed franchise provided that not later than Jan. 1, 1913, the company should sell 25 tickets for $1 and 6 for 25 cents, but in other respects the provisions of the proposed ordinance were unsatisfactory to the voters.

*INTERURBAN RAILWAY MERGER NEAR CHICAGO.*—The Chicago, Joliet & East St. Louis Electric Railway Company has been incorporated, and it is said that this company has been formed as a holding company for four existing companies which will be merged in it. These companies are the Joliet & Southern Traction Company, Joliet, Plainfield & Aurora Electric Railway Company, Bloomington, Pontiac & Joliet Electric Railway Company and Chicago, Joliet & Central Illinois Electric Railway Company. Mr. H. A. Fisher, of Joliet, is prominent in the new enterprise, and in addition to serving an extensive territory south and west of Chicago, the purpose apparently is to connect the Illinois Traction System at Bloomington with the elevated railway system of Chicago, forming a connection with the latter at the terminus of the Douglas Park Branch of the Metropolitan West Side Elevated Railway Company.

*COMBINATION WIRELESS TELEGRAPH RECEIVER.*—In the article which appeared in our issue dated Dec. 2 (page 1355), describing a new type of combination wireless telegraph receiver adopted for use in the United States Navy, it should have been stated that the receiver is manufactured by the Wireless Specialty Apparatus Company from designs of Mr. G. W. Pickard, its consulting engineer.

*KING LEOPOLD INTERESTED IN ELECTRIC RAILWAYS.*—According to newspaper dispatches the fact has been revealed since the death of King Leopold, of Belgium, that among the American securities in his possession were many shares in interurban electric railway companies, especially in the State of Indiana. The late king was a notable business man, but it is not generally recognized that he was a heavy investor in American electric railway stocks.

*SOCIETY OF AUTOMOBILE ENGINEERS.*—The annual meeting of the Society of Automobile Engineers will be held Jan. 13 at the Automobile Club of America, New York City, during the automobile show to be held under the auspices of the Association of Licensed Automobile Manufacturers. The result of the annual election of officers will be announced at that time. The electrical exhibits of the "A. L. A. M." automobile show will be shown at Madison Square Garden and will include displays made by nine manufacturers of electric pleasure vehicles, five manufacturers of electric commercial vehicles and six makers of automobile batteries.

*NEW YORK SECTION, I. E. S.*—The New York Section of the Illuminating Engineering Society held its December meeting in connection with the National Commercial Gas Association's convention on Dec. 17. Mr. H. Thurston Owens presented a paper devoted to street-lighting fixtures in Europe. In a paper describing the lighting of the office building and display rooms of the Consolidated Gas Company in New York, Messrs. V. R. Lansingh and E. B. Rowe gave some interesting data relating to the absorption of light by walls of various colors. In five rooms having white ceilings the foot-candles of illumination produced by lamps of identical arrangement and candle-power varied according to the color of the side walls as follows: Green, 1.57; red, 1.87; blue, 2.36; cream, 2.93, and salmon, 3.34.

*ELECTRICITY PREVENTS FIRES IN RAILROAD WRECKS.*—An unusual number of railroad accidents have occurred in various parts of the country during the last few weeks, and accounts of these disasters in the newspapers have been read with sympathetic attention. However, it is to be remarked that further horror of fire has not been characteristic of recent wrecks, and this is at least partly due to the doing away with open-flame illuminants by the use of electricity. The use of electric heaters also prevents scalding from broken steam pipes in case of accident. Referring to a railroad wreck which occurred at Western Springs, Ill., on Dec. 18, a Chicago daily makes this significant comment: "The cars were heated and lighted by electricity, so that there was no danger from fire."

*MUNICIPAL FREIGHT SUBWAY PROPOSED FOR CHICAGO.*—At the recent meeting of the American Institute of Architects in Washington, D. C., Mr. F. A. Delano, president of the Wabash Railroad, discussed the railroad terminal problem in Chicago. He suggested that freight should be handled in less densely populated portions of the city, and to do this the municipality might furnish a tunnel or subway under the streets, bisecting the wholesale business district. This freight subway should be provided with a platform or conveyor moving intermittently or else continuously at slow speed having at intervals of, say, two to four blocks small stations for the receipt of freight. The conveyor should be arranged to move in a subway loop through the heart of the city, but emerging from that and proceeding along some railway right-of-way to a convenient outside depot or clearing house for the loading of freight.

*ELECTRIC MARINE PROPULSION.*—In a paper presented before the Institute of Civil Engineers Dec. 7, Mr. H. A. Mavor advocated the use of electric motors for ship propulsion. To illustrate the advantages, comparisons were made on the basis of certain definite types of ships. In the case of an 840-hp cargo vessel, an oil-engine electrical equipment would weigh 270 tons as against 570 tons for a steam equipment, fuel being included in both cases, while the saving in operation would be $25 per day. In the case of a 770-hp vessel equipped with a gas-engine plant, the corresponding weights would be 229 and 446 tons, with an equally favorable economy of operation. The case was discussed of a 1030-hp cargo vessel equipped with a turbo-generator, and also that of a 16,290-hp passenger vessel with electrical equipment.

*SAN FRANCISCO UNDERGROUND CONDUIT ORDINANCE.*—At a meeting of the Board of Supervisors of San Francisco, on Dec. 6, an ordinance requiring metal conduits for insulating electric wires, instead of the wooden ones such as are used at present, was passed to print. The ordinance provides that "all electrical wires hereafter installed in or on buildings or other structures within the fire limits of the city and county of San Francisco shall be enclosed in 'National Code Conduit,' or other approved armored conductors; provided, however, that such wires when used for telephone, telegraph, district messenger, call bell or similar systems are exempted from the foregoing provisions. The ordinance does not prohibit temporary installations of other methods of electrical construction for decorative or display purposes, and the Department of Electricity is authorized to grant special permission for such temporary installations for a period not to exceed 60 days.

*PRONUNCIATION OF NUMERALS OVER THE TELEPHONE.*—For a long time telephone companies have instructed their operators to use the word "O" instead of the numeral "naught." This is intended to do away with errors. For instance, "Five-double-O-eight" comes more certainly over the telephone than "five thousand and eight" or "fifty-naught-eight." Following this, an effort is being made to identify the digit "three" by trilling the r's. Wherever "three" occurs in a telephone number, the operators in some of the large exchanges now trill the word so that it becomes "thr-r-r-ree." The purpose of this is far from being any affectation, but a laborious effort to identify this numeral at least so that it may not be confused with others. If some method could be devised similarly to differentiate "five" and "nine," telephone traffic managers would rejoice. With the same long vowel sound and with an indistinct aspirate in the case of "five," these numbers are often confused, and errors result in making connections.

*GAS-ENGINE PRODUCER PLANTS FOR SHIP PROPULSION.*—The engineer-in-chief of the U. S. Navy, in his annual report, refers to the rapid progress in the development of large gas-engine machinery operated in connection with gas producers and states that this prime mover is worthy of much more serious investigation and experiment than has yet been given it in the navy. It is possible, he said, to design a marine plant composed of bituminous coal gas producers furnishing power to gas engines. There are several such plants already in existence; and although they are small, they prove the feasibility of extending this system of developing power to larger installations. "Great possibilities for improving the economical operation of machinery are offered by the producer gas engine combination. We cannot afford to delay development of the gas engine for naval use until commercial gas-engine plants, directly adaptable to naval use, are regularly on the market, and it is, therefore, recommended that special authority be secured in the next appropriation act for the diversion of not more than $250,000 of the appropriation 'Steam Machinery' for the purchase and installation of a producer gas-engine plant in one of our colliers, if at any time during the year such an expenditure is deemed advisable."

*ELECTRIC CLUB ENTERTAINMENT.*—It is announced that the Electric Club of Chicago will give a smoker and vaudeville entertainment on the evening of Jan. 7 in the grill room of the Automobile Club. Tickets will be sold to members at 75 cents each. Mr. George H. Porter is chairman of the entertainment committee.

*TELEPHONE SPEECH CURRENTS.*—In a paper presented Dec. 14 before the Pittsburgh Section, A. I. E. E., Messrs. E. B. Tuttle and W. V. Read gave the result of a study of telephone transmission by means of the oscillograph. Mr. Tuttle has succeeded in obtaining oscillograph curves of telephone speech currents which are capable of accurate analysis to the ninth harmonic. It was found that the even harmonics are fully as important in speech current waves as are the odd harmonics.

*PENSIONS TO ELECTRIC TRACTION EMPLOYEES.*—The Brooklyn Rapid Transit Company, which employs 13,000 men, has adopted a pension system for veteran employees. Each employee who has served 35 years will be entitled to receive 50 per cent of his monthly pay when he reaches the age of 70 or is retired through incapacity between the ages of 65 and 69 years. The minimum limit of service to entitle the employee to participation is 25 years, the pension being graded down to 30 per cent for such workers.

*ELECTRIC HEATERS CRITICISED FOR BEING TOO GOOD.*—Electric heaters in cars have sometimes been accused of not furnishing enough heat, but one man who writes to the Chicago papers complains that they furnish too much. He contends that passengers on the Oak Park elevated cars suffer by being obliged to "sit on seats so hot that one's anatomy is roasted to an overdone condition." He suggests that passengers be furnished with asbestos pads to be used when sitting over the electric heaters. This is certainly a gratifying, if rather unusual, testimony to the efficiency of this class of apparatus.

*N. E. L. A. COMMERCIAL PROGRAM COMMITTEE.*—The first meeting of the Commercial Program Committee of the National Electric Light Association was held in New York on Nov. 27, to formulate plans for the next convention. A strong sentiment developed in favor of a curtailment in the length of the commercial program next year, in order that the principal topics of interest may be taken up and discussed widely. With this in view, fewer papers will therefore be presented next year, every effort being made to bring out a thorough discussion. The committee will hold its second meeting in Chicago during the week of the Electrical Show.

*LOCOMOTIVE FUEL WASTES.*—In a report of the U. S. Geological Survey, it is estimated that of 90,000,000 tons of coal consumed annually in this country by locomotives, 18,000,000 tons are wasted in standby and other periods when no load is being hauled, and 8,640,000 tons are lost in cinders and sparks. Both of these items are saved in electric traction, and the radiation and leakage, which correspond to 5,040,000 tons, greatly reduced. The heat actually transmitted to the boiler is 41,040,000 tons, which would be halved in the case of high-efficiency electrical generating engines. The saving in coal which electric traction renders possible is thus not far from 50,000,000 tons per annum, or more than 50 per cent.

*UNIVERSITY OF MICHIGAN ENGINEERING DEGREES.*—The University of Michigan has adopted a new schedule of engineering degrees whereby the former degree of bachelor of science in electrical engineering, etc., conferred at the end of four years' work, will be changed to read bachelor of electrical engineering, etc. The degree of master of science in engineering will remain unchanged. In the six years' course the degree of bachelor of science in preparation for engineering will be changed to master of science in engineering. The degrees of master of electrical engineering, etc., conferred at the end of six years, remains unchanged, as well as the degrees of civil engineer, etc., which are conferred upon those who receive a bachelor's degree after a five years' course and at least one year of professional work and also a year of advanced work accompanied by a thesis.

*ENGINEER-PHYSICIST EXAMINATION.*—The United States Civil Service Commission will hold an examination Jan. 12 for the appointment in the Bureau of Standards of an engineer-physicist at $3,000 per year and associate engineer-physicist at $2,000 per year. Applicants should be fully able to initiate and carry on independent research in the field of engineering physics, and should have training and experience in the inspection and testing of engineering and structural materials, the operation of testing machines and the interpretation of the results of investigations. There will be no educational examination for these positions, but it is essential that applicants should have made and published some contributions of recognized merit in engineering knowledge. Applicants should submit the titles of all papers they may have published and give references to the original source of publication.

*DEATHS FROM ELECTRIC SHOCK IN SWITZERLAND.*—The number of deaths annually in Switzerland due to electric shock has been almost stationary during the past five years, the figures being respectively 36, 30, 35, 35 and 36. Of the 36 victims of last year, 28 were engaged in electrical callings, and five were building mechanics killed while working by coming in contact with live conductors, principally on the roofs of buildings. Of the remaining three victims, one was a servant, another a factory hand and the third a child. An analysis made of the accidents showed that the greater number was due to lack of precaution on the part of the victims, particularly in the cases of the electrical employees. The servant attached a wire to a kite line to lengthen it and the wire came into contact with a 6000-volt conductor. The child climbed the pole of a high-tension line and touched a conductor, death in this case being probably due to the fall.

*WIRES OVER RAILROADS.*—The Railroad Commission of Indiana has issued a circular in which it is stated that information has come to the commission that numerous telegraph and telephone wires crossing interurban and steam railway rights-of-way are so constructed as to be sources of danger by reason of their coming in contact with high-tension wires or with the trolley wire of the electric lines, and that many wires crossing steam railways are too low for safety or are insufficiently supported. The peril from these defects arises either (1) from the wires being stretched too low; (2) or from their being fastened to weak or rotten poles, or with insecure fastenings; (3) or from their being constructed of inferior material which rusts out or breaks; (4) or because the supports are too far apart, causing sagging; (5) or from absence of guards to prevent sagging or dropping of the wire. Trainmen are exposed to extreme hazard if such wires sag or break, especiially if they come in contact with others of higher potential, and the commission calls attention to the following section of the statutes: "All telegraph, telephone, electric light and all other wires of any kind hereafter constructed over the tracks of any steam railroad within the State of Indiana shall be supported by good, substantial wooden poles of a size not less than 12 in. in diameter at the bottom and not less than 6 in. in diameter at the top, or iron or steel poles not less than 5 in. in diameter at the bottom and 3 in. in diameter at the top, such poles to be set in the earth to a depth of not less than 6 ft. and to be well tamped. All such wires shall clear the top of the rails at least 25 ft. and shall be secured to the poles in such manner as will properly hold them; provided, that in case of the trolley feed and other wires of any electric railway extending over the tracks of any steam railroad in this State the height of such wires above the tops of the rails of such steam railroads shall be not less than 22 ft."

# Madison River Hydroelectric Development.

THE Madison River Power Company is owned by the Butte Electric & Power Company, a corporation which is rapidly gaining control of the electrical situation in the State of Montana.

There are at present five generating stations included in this system, all of which are operated in parallel. These are the Madison plant, one at Big-hole on the Big-hole River, and smaller ones at Parrot, Livingston and Butte, the latter two being both generating and consuming stations. Besides these, there are now under construction at Great Falls, developments

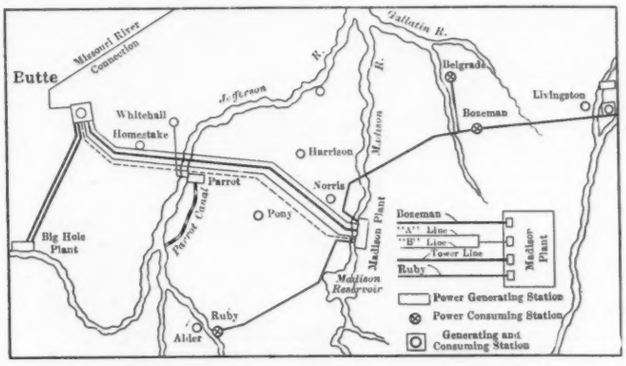



FIG. 1.—MAP OF TRANSMISSION SYSTEM.

capable of at least 100,000 hp. It might be added that in winter the plant at Parrot cannot be operated as a generating station, owing to lack of water, and that then the units are used at this time as synchronous motors to improve the power factor of the system.

Of all the stations now in operation the Madison is the most important. This development consists of two generating

FIG. 2.—VIEW SHOWING SECTION OF STAVE PIPES AND STATION NO. 1.

plants in the Madison River Canyon, which is 60 miles southeast of the city of Butte. The river at this place flows into a narrow canyon formed by solid rock and hills rising precipitately to a height of several hundred feet above the river. At the head of this canyon an artificial lake has been formed by backing the water from a concrete dam, two miles below, into a large basin of meadow land. This reservoir is six miles long by three miles wide.

From the dam run two wooden stave pipes of 10-ft. and 12-ft. diameter. They follow a grade cut in the mountain sides for two miles and empty into a concrete pressure chamber above station No. 2. To lessen the constant danger of pipes being crushed by boulders, which not infrequently come bounding down the hills, a heavy guard fence has been erected. This fence is built of heavy log posts and 2-in. steel mine cable and has been tested to withstand almost any shock that falling rocks might inflict on it.

Station No. 1 was put in operation about 11 years ago. It contains two 1000-kw General Electric alternators, each directly connected to two 62-in. reduced capacity Leffel turbines operating at a 60-ft. head. At present this plant is run only at times of high peak, owing to lack of sufficient water to operate both plants at full rated output. At times of high peak this station is connected in parallel with station No. 2 and is loaded up with the wattless current of the system, thereby raising the power factor. Water is supplied to the two steel pressure chambers through an 8-ft. stave pipe tapped into the 12-ft. pipe at the head-works.

The real development, however, is in the lower station. From the pressure chamber above this station run four steel penstocks to the four units. Each unit consists of one 2400-kw General Electric alternator directly connected to two specially constructed high-head Leffel turbines. The average head is 110 ft. The speed of each unit is regulated by a Lombard governor which gives perfect control of the unit load, either from the floor or from the board in the gallery.

In Fig. 1 is illustrated the plan of the transmission system. There are five lines leading from the Madison station. The voltage of transmission on all lines is 60,000.

Of all the lines shown the three parallel lines running over the divide to Butte, 60 miles distant, require the most careful attention, as they carry the greater part of the station output. The power is used in Butte for illumination, street railway service and for the motors in the numerous copper mines; the big smelter at Anaconda also takes about 5000 kw in an induction motor load. Two of these Butte lines are of wooden pole construction and between these is a steel tower line.

On the pole lines use is made of aluminum cables insulated by the ordinary triple-petticoat glass insulator. On the tower line are copper cables; here the insulator consists of two

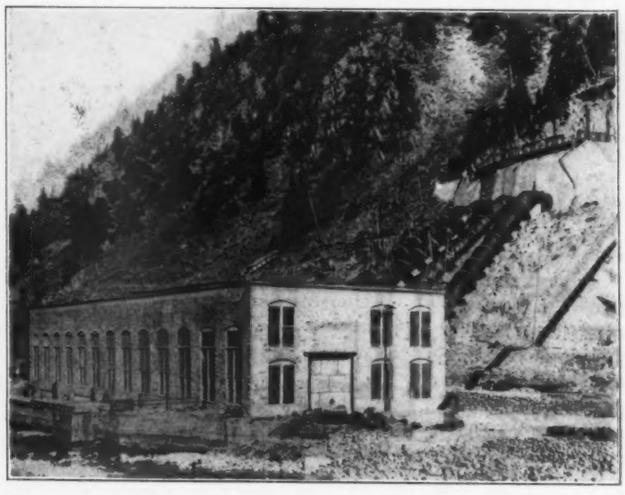


FIG. 3.—GENERAL VIEW OF STATION NO. 2.

separate porcelain disks fastened together by a patent hanger; to these is suspended a yellow pine stick, 2 in. square by 2 ft. long, to which the cable is attached. The pine stick is heavily impregnated with paraffine and adds materially to the breakdown strength of the insulator. The longest tower span is 2500 ft., the average span being about 500 ft.

The country through which these three lines pass is well calculated to cause a maximum amount of trouble to continuous operation. The lines, passing through valleys and over moun-

tains, are subject to great potential differences to ground, due to differences of atmospheric potential in different regions. Terrific wind-storms often occur, defying almost any mechanical construction. There are great and sudden variations of temperature, often causing snapping of cables, particularly on the aluminum lines. In summer local thunder-storms occur almost daily over some part of the line, giving much trouble from lightning.

The station is protected from all lines by multi-gap arresters in series with horn-gaps. Since the Butte lines carry the greater part of the station output, extra precautions are taken to keep the service continuous. The tower line is so well protected from lightning by the overhead grounded cables, and so rigid in mechanical construction that grounds seldom occur, and multi-gap arresters alone are found sufficient for its protection.

On the pole lines, however, additional protection is offered by aluminum lightning arresters. Arcing grounds are not infrequent on the pole lines and the resulting current surges cannot, of course, be handled by any multi-gap arrester. The aluminum arrester satisfies this abnormal condition, as it is able to discharge continuously for half an hour. These arresters are placed outdoors in waterproof cases. The non-grounded neutral system of transmission requires three line stacks of aluminum cones and one ground stack. These cells cannot, of course, be permanently connected in circuit, as the small charging current would heat the electrolyte. They are, therefore, connected in series with horn-gaps. Furthermore, when the cells are left out of circuit for some time, the film

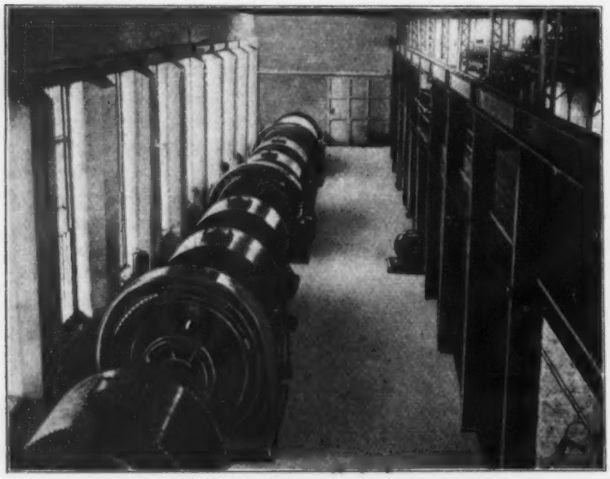


FIG. 4.—TWO GENERATORS WITH TWIN TURBINES, STATION NO. 2.

of aluminum hydroxide on the cones dissolves; the result is that if a high-tension surge should come over the arrester there would be an extremely heavy rush of current for an instant until a new film could form. By charging the cells daily and keeping the film formed at all times the initial rush of current is prevented and the ultimate temperature rise in case a current surge is minimized. The charging is done by the operator after each eight-hour shift, requiring only two or three minutes' time. It is accomplished by closing for an instant the horn-gaps first on the three line stacks, throwing these directly on the high-tension lines; then interchanging, by switches, one line stack and the ground stack and making the charged line stack act as the ground leg; the gaps are again closed, recharging the two remaining line banks of cells and also that bank of cells which is normally the ground leg. The switching is then returned to its normal position and the horn-gaps set properly.

Outside of the fact of keeping the cells in excellent operating condition at all times, this daily charging gives the operator a good idea of the condition of the cells. The operators become so skilful in judging the size and color of the spark at the gap that any disorder of the arrester is at once detected.

The two-pole lines to Butte are designated as the A line and the B line, and the tower line as the C line. Suppose a cable on the A line, for example, should break or be torn from its insulators by wind and should become grounded. Since the A and B lines are tied together at Madison and enter the station together, the heavy rush of current would trip both relays, thus dropping all load from both lines. The jolt due to the ground knocks all the motor load in Butte out of synchronism and if it is especially severe the induction motor load at Anaconda is also lost. At the first sudden rush of current the governors shift the turbine gates wide open; the relays immediately open the lines, and the turbines with full flow of water and practically no load take on a terrific speed until the governors can get the gates down. From the terminals of each generator, leads are run to a water rheostat buried in the river.

This rheostat can be connected to the machine through an oil switch either automatically or by hand. On the gate shaft of each turbine is a large cam; when the gates are closed to

FIG. 5.—VIEW OF STAVE PIPE IN COURSE OF CONSTRUCTION.

about the 800-kw mark this cam releases a pin, thereby allowing a counterweight to close the oil switch. Each rheostat can carry about 750 kw. The governors as a rule close the gates almost instantly, thus throwing in the rheostats as they pass the 800-kw mark. Occasionally, however, a gate sticks and the governor is unable to operate it quickly. In this case the three rheostats that are in service quickly decrease the speeds of their three generators down to a safe value and also pull on the fourth till the floor man can insert the rheostat by hand and work the gate down with a bar. It is seen that although one gate should stick even wide open and the other three should close promptly, the four rheostats together would throw a load or about 3000 kw on this machine and no racing would result.

The corporate interests of the Butte Electric Company at the Madison plant are in charge of Superintendent M. E. Buck, a pioneer in high-tension transmission work. To him is due all credit for the engineering features of the layout and construction of this hydraulic plant and for the economic and profitable basis upon which it is operated.

# Train Operation in Chicago Freight Tunnels.

ONE of the interesting features of the system of freight tunnels underlying the heart of Chicago is the method adopted to secure safety in train operation. There are 60 miles of these tunnels laid under the streets in the central business district of the city. The tunnels are used for the transportation of freight on narrow-gage electric railways, and no passenger traffic is accepted. They are connected to all the freight houses of the railroads entering Chicago, and in addition to many wholesale and retail business houses and office buildings, as well as to buildings in course of construction for the removal of excavated material.

In addition to the transportation of freight and merchandise and the removal of earth from excavations, a considerable business is done in the delivery of coal to office buildings and the removal of ashes. Where excavated material is to be removed from building sites a chute is erected, extending down to the tunnel. For the handling of coal and ashes in a number of cases elaborate conveyors have been installed in sub-basements, or else shafts have been laid down to the tunnel through which coal is lifted up to the basement level and ashes taken down to the tunnel level.

The average depth of the bottom of the tunnels from the surface of the street is 42 ft. Tunnels are built of concrete 10 in. thick at the top and sides and 14 in. thick at the bottom. They are of the shape of a horseshoe. The interior dimensions of the typical tunnel are 6 ft. wide x 7½ ft. high, but in a few cases there are trunk tunnels 12 ft. wide and 14 ft. high. Fig. 1 gives a good view in the tunnels, showing a typical street intersection. The overhead cables shown enclose wires used in automatic telephone service. Fig. 2 shows the tunnel connection with the Heyworth Building at Wabash Avenue and Madison Street. Here a by-pass from the tunnel leads into the building, which has a deep level sub-basement. Fig. 3 shows another arrangement for building connection, in this case with the Majestic Theater Building on Monroe Street. Here there is a by-pass from the main tunnel and a shaft from the by-pass connecting with the coal conveyor in the building. In addition there is an ash chute 3 ft. in diameter.

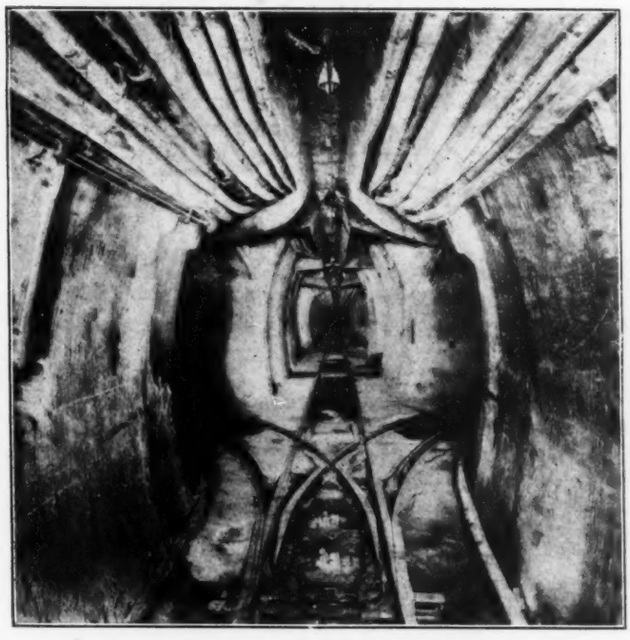


FIG. 1.—TYPICAL STREET INTERSECTION.

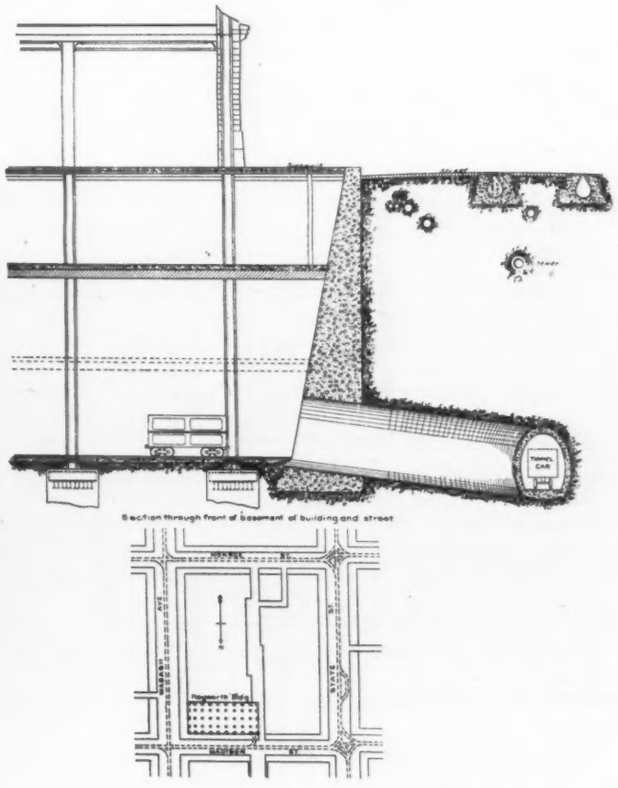



FIG. 2.—CONNECTION TO HEYWORTH BUILDING.

Drainage is provided by electric pumps, the discharge pipes of which are connected with the city sewers. The suction pipes of the pumps are connected with special tile sumps distributed throughout the entire system. No special provisions for ventilation are needed, as with its many connections to the outside air the tunnels form in themselves a vast ventilating system, and there is always a current of air to be observed in them. The temperature of the air in the tunnels remains uniform during the year at from 55 deg. to 60 deg.

The track of the narrow-gage railway consists of 56-lb. rails, mounted on cast-iron chairs embedded in the cement, with a gage of 2 ft. An overhead trolley wire is used; the system is operated at 250 volts by direct current, it being thought that, owing to the small dimensions of the tunnel and the constant dampness, a higher potential would be unsafe. Electric energy is purchased from the Commonwealth Edison Company. Specially designed electric locomotives, resembling the mining type, are used, and to these are coupled platform cars having a carrying capacity of three tons each. These cars, which are provided with removable vertical stakes fitting in sockets, are 12½ ft. long and 4 ft. wide. Eight cars constitute an average train. Each locomotive is equipped with two 25-hp motors and hand brakes. Each motorman operates his own train without assistance, there being no conductors or brakemen. The movement of cars is in only one direction, up one street and down another.

Fig. 4 is a map of the tunnel system, showing the location of intersections and curves. There are 593 tunnel intersections, of which 370 are two-way intersections, 94 three-way, 112 four-way and 17 of special construction.

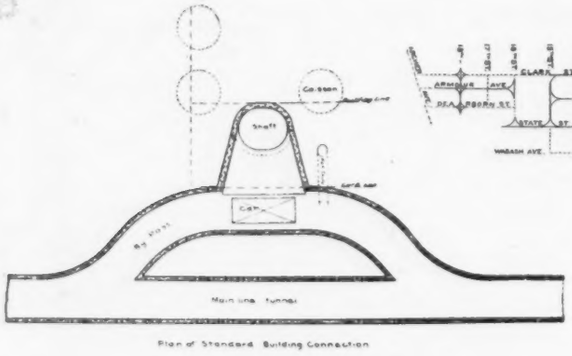
To provide a signaling system under the conditions met in these tunnels has been a perplexing task. Apparatus had to be devised to protect a river drift as well as the ordinary and special intersections mentioned. Some of the signals at the special intersections must be non-operative under certain conditions, but still give a cautionary signal. In addition there must be protection in the river drifts against runaway cars. Tunnel conditions are such that the use of track circuits is an electrical impossibility. In spite of the efforts to insure drainage, there is always moisture present in the tunnel, and this moisture is charged with various earth salts. It was therefore found necessary to abandon the idea of using the track rails

for signaling. This necessitated the use of trolley contactors or some specially insulated devices at the level of the tracks.

When the Illinois Tunnel Company, which operates the tunnels, asked for bids for equipping the subway with signaling devices, the management was informed by the signal manufacturers that the situation presented a different problem from any that had arisen in the history of railroad construction. The tunnels constitute a network of tracks, loops and crossings, with intersections at every city block, and how to protect the system by signal devices that would prove effectual and still permit the operation of trains without too much delay was indeed a difficult question.

Finally, Mr. S. S. Stolp, signal engineer of the company, and Mr. W. J. C. Kenyon, formerly vice-president, developed and installed a patented system of signals of their own which they called the Stolken system of automatic electric-railway-crossing block signals, the trade name being a word coined from the names of the two inventors. This system has been in operation in the subway for the last 18 months, and has been installed at 38 of the 50 especially congested points therein. It is being extended to other intersections as rapidly as possible. Formerly a flag system was in use at intersections, but the Stolken automatic apparatus saves about one-half the power and time formerly consumed with the flag system.

The apparatus for protecting a four-way intersection of two tracks, on each of which there is traffic in only one direction, comprises red signal lamps, though, of course, semaphores may be substituted for the lamps or used in connection with them.



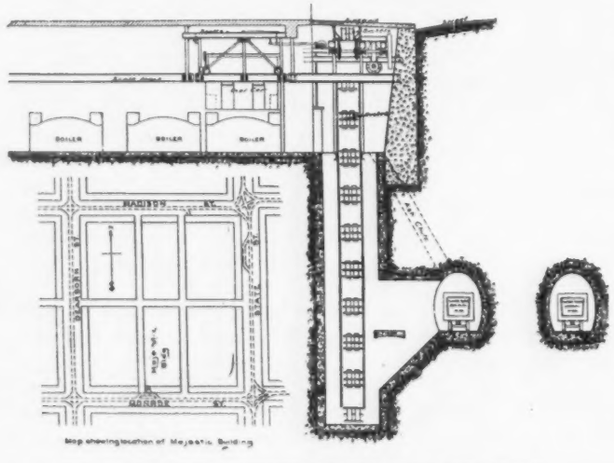




FIG. 3.—BUILDING CONNECTION FOR COAL AND ASHES.

Fig. 5 is a reproduction of a photograph taken at the entrance to a four-way intersection not shown in the picture. A train is shown entering the portion of the tunnel immediately adjacent to the intersection and protected by the signaling system. The two red lamps of the signal (ordinarily enclosed in an iron case with magnifying lenses) are shown prominently at the right of the picture. The trolley contactor is also shown just in advance of the trolley wheel. When this contactor is tripped by the passage of the trolley wheel, one of the lamps lights up. This is a signal to a following train, while that lamp is burning, that a train ahead is passing the intersection. The other lamp indicates, if lighted, that a train is passing the intersection from the other direction—that is, at right angles to the passage of the first train. After the train has set the signal in warning state it crosses the intersection, and its departure automatically restores the signal to the normal no-signal state. Thus both rear-end and crossing collisions are guarded against. In addition to the red lamps, a green lamp is provided on each track to indicate to the operator on an approaching train that his signals are working properly and gives him permission to go ahead.

The apparatus to accomplish these results consists of: (1)

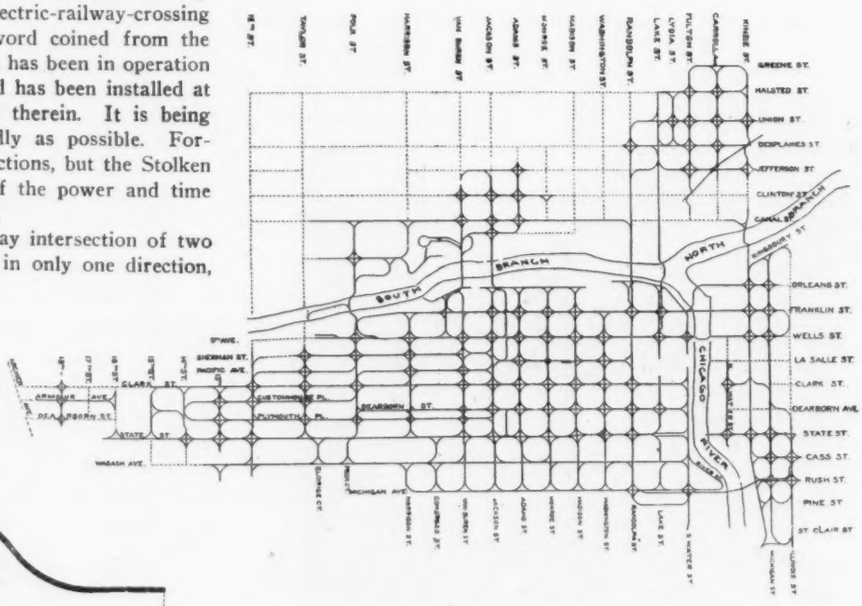



FIG. 4.—MAP SHOWING LOCATION OF TUNNEL INTERSECTIONS AND CURVES.

"On" contactors, which may be placed beside the track rails or above the trolley wire, as shown in Fig. 5. These are actuated by a train approaching the intersection. (2) A relay working in oil to which conductors lead in from all the contactors. (3) Signal lamps whose circuits lead out from the relay and are controlled thereby. (4) "Off" contactors placed similarly to the "on" contactors to be actuated by a train as it departs from the intersection.

In the same oil tank with the relay are simple switches, one for each track, which can be thrown over manually and thereby interchange each "on" contactor with its respective "off" contactor and also change the connections of the signal circuits, so as to adapt the system for traffic in a reverse direction.

It is obvious that the contactors are very vital and important features of the system. If the contactors work surely and properly there can be almost no chance of failure, because the relay working in oil is very certain in its operation, and the signal circuits are not liable to get out of order. The trolley contactor is a remarkably simple and sure device. It consists of a cast-iron box mounted upon the trolley wire and filled with an insulating medium, such as vaseline. A transverse shaft extends through the box, being journaled in its side walls, and the arms hang down from the ends of the shaft in the path of the trolley wheel or harp, as may be seen in Fig. 5. Inside the box the shaft carries a circuit-closing member. The relay is so arranged that when the depending arms are struck by the trolley wheel or harp and the circuit leading to the relay from the trolley wire is thereby closed within the box, then, even though the closure is only momentary, and even though it may be repeated by the arm swinging like a pendu-

lum, in any case the signal circuits are at once closed and held closed at the relay. The mechanical and electrical details of this trolley contactor are very simple and are well worked out.

The rail contactor also has its contact members working in a box of oil, and it is so constructed as to be unaffected by water and to be able to withstand the pounding it receives from the car wheels as they successively pass over it. In case two trains on respective tracks approach their respective "on" contactors at about the same time, the train which strikes its "on" contactor first, even though the difference be only one thousandth of a second, will get the green permissive signal to go ahead, while the other train will get a red warning signal to stop. However, by a simple artifice the relay is so constructed

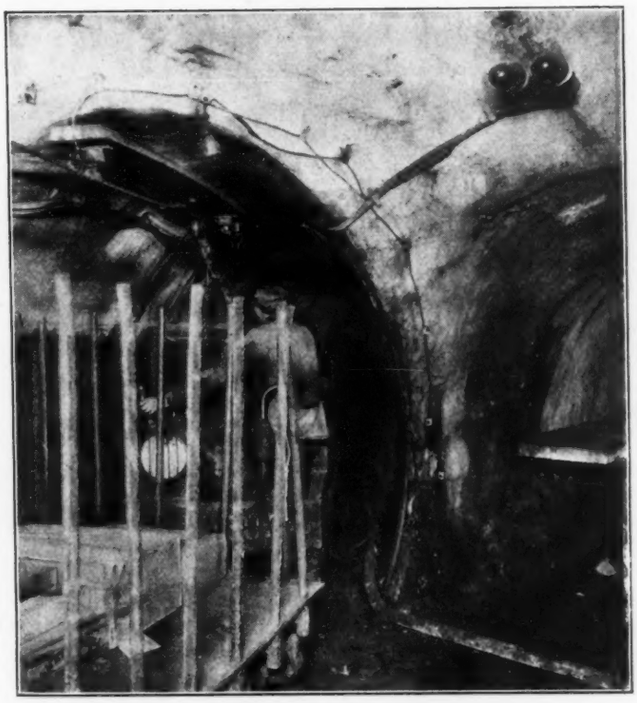


FIG. 5.—VIEW SHOWING TROLLEY CONTACTOR AND SIGNAL LAMPS.

that when the first train actuates its "off" contactor on departing from the intersection, then automatically the red light, which holds the other train blocked from the intersection, will change to green, and all the other signals will change to correspond. Thus the second train is held until the first train clears the block and then the second train is given the right of way automatically.

In such a case as this, it will be noticed that if rail contactors are used, then the first wheel of the departing train that strikes the "off" contactor will release the waiting train to go ahead; if thereupon the waiting train starts up immediately its wheels will successively actuate the "on" contactor on the corresponding track at the same time that the successive wheels of the departing train are actuating the "off" contactor on the other track. This would obviously confuse the signals; therefore, when rail contactors are used a "time-element" is introduced so that a certain arbitrary time must elapse after the "off" contactor is actuated before the signals are effected thereby. The arbitrary time is made such that the departing train will surely entirely pass its "off" contactor before the permissive signal is given to the other train. Obviously, this time-element mechanism is not necessary when the trolley contactor is employed.

The time-element mechanism consists of a pendulum acting in combination with an electromagnet and a ratchet wheel and pawl so that the ratchet wheel is stepped along one tooth at a time for each beat of the pendulum. The closure of the "off" contactor sets the electromagnet to driving the pendulum and after the ratchet wheel has thus been moved to a certain distance an electrical contact is closed (or broken) so as to actuate the relay and make the appropriate change in the signal circuits.

Although the system is adapted to be supplied with all necessary electric current from ordinary trolley wires, it is so designed that nowhere is there any appreciable sparking or arcing at contacts. Another important practical feature is that whenever the apparatus is exposed in any way it is at that point thoroughly "fool-proof." For example, in the crossing bell, the apparatus is almost all inside a locked box, and what little apparatus is outside this box is extremely simple and strong.

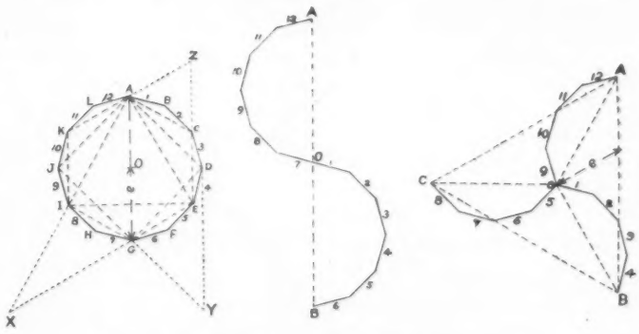
Printed instructions are issued to motormen in the Illinois Tunnel System governing the operation of trains where signals are installed. It is announced that any employee disregarding a properly working signal will be immediately discharged. Employees are told that the green signal is a permissive signal to proceed with train under control. The red signal is a danger signal and means "Stop!" In addition there is, at some points, a "flag" signal—that is, the lighting up of a lamp behind a ground-glass plate bearing the word "Flag." This is occasionally used as a cautionary signal, and means "Proceed with caution." The absence of a signal means danger. If, for any reason, the signals do not work properly, or if the red danger signal remains set longer than three minutes, motormen may proceed with caution, reporting the circumstance to the dispatcher from the nearest telephone.

## Vector Diagrams of Polyphase Windings.

By M. V. AYRES.

THE general use of three-phase generators to supply energy for the operation of single-phase railways has led the writer to make a study of the theory of various polyphase and single-phase windings of generators with reference to their adaptability for supplying single-phase energy. This study developed into a systematic treatment of the general subject of polyphase windings, which, while it probably contains nothing new to designers of such apparatus, appears to be novel and instructive in method and scope.

In what follows there is assumed a machine having six slots per pole, that being the minimum number that will give all the combinations to be considered herein. Let this machine be wound with two coils in each slot, all of full pitch, and connected as they would be in a direct-current drum winding. The slots are 30 electrical space-degrees apart, and, therefore,



FIGS. 1, 2 AND 3.—E.M.F. VECTOR DIAGRAMS.

the e.m.fs. generated in the conductors of these slots will follow one another with 30 deg. time-phase displacement. Following a closed circuit around through the armature, and representing each e.m.f. by its appropriate vector line, there is obtained the 12-sided polygon, Fig. 1, in which the sides 1, 2, 3, 4, . . . . . 12 represent the various e.m.fs.

By taking off taps at the points *A, B, C,* etc., which represent the ends of the various coils, one may obtain various different e.m.fs. Assume that the output of the machine is limited to a rated current per coil of *i* amp, and a rated voltage per coil

such that the diametrical volts $\overline{AG} = 2e$ volts. Then $e$ = the radial voltage $\overline{OA}$.

*Case I. Single-phase.*—Taps are taken off at $A$ and $G$ in Fig. 1. $E$ = external volts = $\overline{AG} = 2e$; $I$ = external current = $2i$; $W$ = watts output = $EI = 4ie$.

*Case II. Three-phase.*—Taps are taken off at $A$, $E$ and $I$, in Fig. 1. $E$ = external volts = $\overline{AE} = \sqrt{3}e$; $I$ = external current = vector sum of two currents, of magnitude $i$, of phase relation of $\overline{EI}$ and $\overline{AI}$; $I = i\frac{EX}{EI} = \sqrt{3}i$; $W$ = watts output = $3iE = \sqrt{3}IE = 3\sqrt{3}ie = 5.196ie$.

*Case III. Four-phase.*—Taps are taken off at $A$, $D$, $G$ and $J$. $E$ = external volts = $\overline{AD} = \sqrt{2}e$; $I$ = external current = vector sum of two currents of magnitude $i$, of phase relation of $\overline{DG}$ and $\overline{JG}$; $I = i\frac{DY}{DG} = \sqrt{2}i$; $W$ = watts output = $4iE = 2\sqrt{2}IE = 4\sqrt{2}ie = 5.657ie$.

*Case IV.—Six-phase.*—Taps are taken off at $A$, $C$, $E$, $G$, $I$ and $K$. $E$ = external volts = $\overline{AC} = e$; $I$ = external current = vector sum of two currents of magnitude $i$ of phase relation of $\overline{AC}$ and $\overline{EC}$; $I = i\frac{AZ}{AC} = i$; $W = 6iE = 6IE = 6ie$.

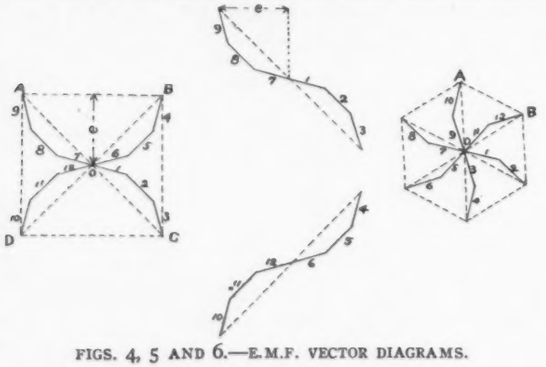
These first four cases represent conditions that can be obtained by taking off the appropriate taps from a direct-current armature winding. It is evident that if the number of slots is increased the polygon of e.m.fs. tends to become a circle; but any change in the number of slots will make no difference whatever in the values of $I$, $E$ and $W$, provided that the number of slots per pole is a multiple of the number of phases.

In these first four cases the output $W$ equals the current per coil $i$ multiplied by the periphery of the e.m.f. polygon, as shown in Table I.

TABLE I.—RELATION OF OUTPUT AND EFFICIENCY TO NUMBER OF POLES.

| | | |
|---|---|---|
| Single-phase | $= W = i \times$ twice the diameter | $= 4.000ie$. |
| Three-phase | $= W = i \times$ three sides of triangle | $= 5.196ie$. |
| Four-phase | $= W = i \times$ four sides of square | $= 5.657ie$. |
| Six-phase | $= W = i \times$ six sides of hexagon | $= 6.000ie$. |
| Infinite number of phases | $= W = i \times$ circle $= i \times 2\pi e$ | $= 6.283ie$. |

While the output increases with the number of phases, the internal losses remain constant, so that the efficiency increases with the number of phases. The six-phase machine comes so



FIGS. 4, 5 AND 6.—E.M.F. VECTOR DIAGRAMS.

near the theoretical maximum that there will apparently never be any reason for making a machine having a number of phases greater than six; therefore, one may take the output of this machine ($6ie$) as standard for purposes of comparison.

If the machine shown in the first four cases has a rating of 1000 kw and an efficiency of 94 per cent at full load, unity power factor, as a six-phaser, then for the other arrangements it will have the following permissible outputs and efficiencies:

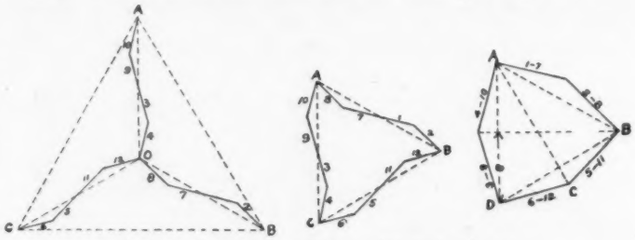
TABLE II.—RELATIVE RATINGS AND EFFICIENCIES.

| Phases, number. | Output, kw. | Efficiency, per cent. |
|---|---|---|
| 6 | 1000 | 94.00 |
| 4 | 944 | 93.64 |
| 3 | 866 | 93.07 |
| 1 | 667 | 91.00 |

The diagram of Fig. 1 represents correctly the conditions in rotary converters and double-current generators; however, hardly any other alternating machines are ever connected in this way. When use is made of the same slots and the same coils, but different connections, one can readily represent the resultant voltages by rearranging the e.m.f. vectors 1, 2, 3, 4, etc., as shown in the following cases:

*Case V. Single-phase, single circuit.*—The two voltages generated with two hemispheres of Fig. 1 are put in series, as shown in Fig. 2. $I$ = external current = $i$; $E$ = external volts = $\overline{AOB} = 4e$; $W = iE = IE = 4ie$.

*Case VI. Three-phase star.*—The arrangement is shown in Fig. 3. $I$ = external current = $i$; $E_1$ = volts per leg = $\overline{AO}$ = $e\sqrt{3}$; $E$ = external voltage = $\overline{AB} = E_1\sqrt{3} = 3e$; $W = 3iE_1 = 3I\frac{E}{\sqrt{3}} = \sqrt{3}IE = 3\sqrt{3}ie = 5.196ie$.



FIGS. 7, 8 AND 9.—E.M.F. VECTOR DIAGRAMS.

*Case VII. Four-phase star.*—The arrangement is shown in Fig. 4. $I$ = external current = $i$; $E_1$ = voltage per leg = $\overline{AO}$ = $e\sqrt{2}$; $E$ = external voltage = $E_1\sqrt{2} = 2e$; $W = 4iE_1 = 4I\frac{E}{\sqrt{2}}$ = $2\sqrt{2}IE = 4\sqrt{2}ie = 5.657ie$.

*Case VIII. Two-phase (or quarter-phase) independent.*—The arrangement is shown in Fig. 5. $I$ = external current = $i$; $E$ = external voltage = $2\sqrt{2}e$; $W = 2iE = 2IE \times 4\sqrt{2}ie = 5.657ie$. This is the usual arrangement of the commercial "two-phase" or "quarter-phase" machine.

*Case IX. Six-phase star.*—The arrangement is shown in Fig. 6. $I$ = external current = $i$; $E$ = volts per leg = $\overline{AO} = e$; $E$ = external volts = $\overline{AB} = e = E$; $W = 6iE = 6IE = 6ie$. The diagram of Fig. 6 is interesting because of what may be derived from it. It exhibits three diameters having the relative phase displacements of regular three-phase e.m.fs., and evidently capable of being connected to form a three-phase winding. This is shown in Case X.

*Case X. Three-phase star.*—The arrangement is shown in Fig. 7. $I$ = external current = $i$; $E_1$ = volts per leg = $\overline{AO}$ = $2e$; $E$ = external volts = $\overline{AB} = E_1\sqrt{3} = 2\sqrt{3}e$; $W = 3iE_1 = 3I\frac{E}{\sqrt{3}} = \sqrt{3}IE = 6ie$. There is here a three-phase connection of the same watt rating as the six-phase connections, and 15 per cent greater watt rating than the three-phase arrangements of Cases II and VI. This can readily be altered into the delta arrangement given in Case XI.

*Case XI. Three-phase delta.*—The arrangement is shown in Fig. 8. $I$ = external current = $i\sqrt{3}$; $E$ = external volts = $\overline{AB}$ = $2e$; $W = 3iE = 3\frac{I}{\sqrt{3}}E = \sqrt{3}IE = 6ie$.

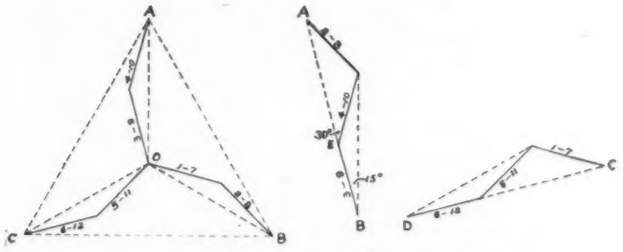
Tables I and II show the three-phase machine at a disadvantage as compared with the four-phase machine. However, for nearly all commercial machines, except the rotary converter and the double-current generator, the three-phase connections given in Figs. 7 and 8, or their equivalent, are used. This arrangement gives the full output and efficiency of the six-phase machine. Therefore, in practice, the two-phase, quarter-phase or four-phase motor or generator is handicapped by 5.6 per cent in permissible output and about 0.35 per cent in efficiency as compared with the three-phase or six-phase machine.

The rotary converter and double-current generator have to be built with a continuous drum winding like that discussed in the first four cases, but with more slots. Therefore, the three-phase, double-current generator has only 86.6 per cent of the rated output of the six-phase machine and 91.8 per cent of that

of the four-phase machine when the machines are running strictly as alternators. This same ratio would hold in the case of rotary converters driven as alternating-current generators, but in the normal use of the rotary the ratio is altered by the variation in the path of the current between the collector rings and the commutator. However, these diagrams show one reason why the six-phase converter is preferable to the three-phase.

If instead of winding the above machine with two coils per slot it be wound with one coil per slot, some new effects are obtained. Phase windings 1 and 7, 2 and 8, 3 and 9, 4 and 10, 5 and 11, 6 and 12 are necessarily in series, because each coil fills the two slots giving parallel e.m.f. vectors. It then becomes impossible to construct a regular polygon from the e.m.f. vectors. The nearest one can come to it is shown in Fig. 9.

*Case XII. Three-phase delta.*—The arrangement is shown in Fig. 9, taps being taken off at $A$, $B$ and $D$. $E$ = external volts $= \overline{AB} = 2e$; $I$ = external current, and is the vector of two currents of magnitude $i$, of time-phase relation of $\overline{AB}$ and $\overline{BD}$;




FIGS. 10, 11 AND 12.—E.M.F. VECTOR DIAGRAMS.

$I = i\sqrt{3}$; $W = 3iE = \sqrt{3}IE = 6ie$. This arrangement gives the same watt rating and the same terminal e.m.f. diagrams as Case XI, Fig. 8.

*Case XIII. Three-phase star.*—The arrangement is shown in Fig. 10. $I$ = external current $= i$; $E$ = volts per leg $= AO = 2e$; $E$ = external volts $= \overline{AC} = \overline{AO}\sqrt{3} = 2\sqrt{3}e$; $W = 3iE_1 = 3I\frac{E}{\sqrt{3}} = \sqrt{3}IE = 6ie$. This gives the same three-phase result as Case X. Obviously this winding, which has six coils per pair of poles, will not produce a six-phase or four-phase interconnected winding. It can be connected, however, for two-phase, as shown in Fig. 11.

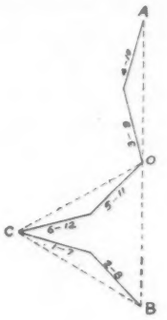
*Case XIV. Two-phase.*—The arrangement is shown in Fig. 11. $I$ = external current $= i$; $E$ = external volts $= \overline{AB} = \overline{BE} + \overline{EA} = e$ sec 15 deg. $+ 2e$ sec 15 deg. cos 30 deg. $= 2.8285e$; $W = 2iE = 2IE = 5.657ie$. This is neither better nor worse with respect to output than any of the two-phase and four-phase connections previously given.

### SINGLE-PHASE OPERATION.

As shown in Table I, where machines have a uniformly distributed winding, the single-phase machine has only two-thirds of the permissible output of the three-phase machine of the same size, besides a much lower efficiency. If a generator is built for single-phase work alone the coils will be more or less concentrated, and it will show up somewhat better; but, at the best, the single-phase machine must be much heavier and more expensive than the three-phase machine. For this reason, among others, most of the single-phase railways are using three-phase machines as generators.

One proposed method of applying three-phase generation to single-phase service is to divide the line into three sections, connect the neutral point of the three-phase machine to the track and feed energy to each section from one leg of the generator. Another way is to divide the line into two sections and feed each from one lead of a two-phase generator connecting the other two leads to the track. A third proposed method is to connect one leg of a three-phase machine to the track and each of the other two legs to a section of the trolley line. All three of these methods are open to the objection that it is impossible to balance the load, even as applying to the general average, and quite out of the question to approach a balanced condition from moment to moment. They are also open to objection on account of the complication of feeders, switches, insulators, etc., that they involve. The third method is an unbalanced system by design. If the loads on the two sections of trolley could be kept the same, the current per coil being limited as in the cases previously considered, this case would work out as follows:

*Case XV. Two-thirds of three-phase.*—The arrangement is shown in Fig. 10, where terminal $A$ is connected to the rail, and $B$ and $C$ to the trolley. Current in $A = i$; current in $B$ and $C = \frac{i}{\sqrt{3}}$; $E$ = external volts $= AB = 2\sqrt{3}e$; $W = 2\frac{i}{\sqrt{3}}E = 4ie$. This is the same output as given by the single-phase connections of Cases I and V. Of course, the total heating is a little less because only one-third of the coils are subject to the full rated load current. On account of the fluctuations in distribution of load between the two sections of line it is probable that this arrangement is actually at a disadvantage as compared with straight single-phase operation.




The New Haven Railroad Company has adopted yet another method. Use is made of a Y-connected three-phase machine, single-phase current being derived from two legs, the other leg being idle. Again assuming the same maximum current per coil, this arrangement works out as follows:

*Case XVI. Single-phase from three-phase, star-connected machine.*—The arrangement is shown in Fig. 10, the current being taken from terminals $A$ and $B$. External current $= I = i$; external volts $= E = \overline{AB} = 2\sqrt{3}e$; $W$ = output $= IE = 2\sqrt{3}ie = 3.464ie$. This is only 57.7 per cent of the three-phase output and 86.5 per cent of the output of the same machine reconnected for single-phase operation.

Any three-phase, star-connected machine can be reconnected for single-phase operation by removing the neutral-point end of one phase from the neutral point to the extremity of one of the other legs. Fig. 12 shows this arrangement as derived from the diagram of Fig. 10.

*Case XVII. Distorted three-phase.*—(See Fig. 12.) External current $= I = i$; external volts $= E = \overline{AB} = 2AO = 4e$; $W = IE = 4ie$. This gives the maximum single-phase output, the same as Cases I and V. Here the voltage is 1.155 times the voltage of the same machine used as a three-phase, star-connected machine; it is double the voltage connected delta.

There remains one method of obtaining single-phase current from a three-phase machine that appears to be open to less serious objection than any other. Let the machine having six slots, and three coils per pole, be delta connected as shown in Fig. 9. Three-phase e.m.f. may be taken from terminals $A$, $B$ and $D$ and single-phase voltage from terminals $A$ and $C$. The single-phase voltage is the same as the three-phase voltage. In this case $I$ = external current $= 2i$; $E$ = external volts $= \overline{AC} = \overline{AB} = 2e$; $W = IE = 4ie$. This gives the same capacity as the other single-phase arrangements of Cases I, V and XVII; that is to say, it gives the greatest single-phase output possible for a distributed winding. It also does not interfere in any way with the simultaneous use of the machine as a three-phase generator of the same voltage.

It is not customary to use the delta connection for machines of so high an e.m.f. as 11,000 volts, but there are no serious difficulties in the way of doing so for machines of moderately large size. There is also no difficulty in using six slots per pole for 25-cycle machine of 11,000 volts and 1000-kw rating or greater, for ordinary engine-driven speeds. Steam-turbine-driven 25-cycle machines would probably work out satisfactorily for either two or three times this number of slots, which would permit of a connection having the same effective e.m.f. diagram.

# CENTRAL STATION

## MANAGEMENT, POLICIES AND COMMERCIAL METHODS

## Street-Lighting Arches in Wilmington, N. C.

The satisfactory results derived from the system of lighting Wilmington streets by arches of tungsten lamps during the Taft celebration in November have induced the city to extend the system so that the downtown section will be included, and an average of four arches to the block will be used. The material for the new arches has been ordered, and by the first of the new year, Wilmington believes it can lay claim to being the best-lighted city in the South with the exception of Atlanta.

## The Salesman's Creed.

The November issue of the *Engineering Quarterly* of the University of Missouri contains an interesting paper by Prof. H. Wade Hibbard, of the mechanical engineering faculty of the university, entitled "The Science of Engineering Salesmanship." After a discussion of modern industrial and commercial methods the writer takes up the personal qualities desirable for salesmanship and analyzes the elements which enter into a sales transaction. Manufacturers, it is stated, who once said salesmen are born, not made, are now beginning to make them. Principles of selling are investigated and brought to uniform practice. "The day of the crafty, tricky, glib, ill-educated, loud and intemperate salesman is gone. Now he must be honest and have a reputation for honesty, be an expert in evidence, a trained logician, well educated and able to meet his customers on their own ground, of good health that his mind may be alert and personally attractive, acquainted with the practical physiology of typical customers, able to give proofs so pointedly that the purchaser can be brought quickly to the closing of the sale." The paper concludes with the following "Salesman's Creed":

"I believe in the goods I am selling, in the firm I am working for, and in my ability to get 'results.'

"I believe that honest goods can be sold to honest men by honest methods.

"I believe in working, not exacting; in laughing, not weeping; in boosting, not knocking, and in the pleasure of selling goods.

"I believe that a man gets what he goes after; that one order to-day is worth two orders to-morrow, and that no man is down-and-out until he has lost faith in himself.

"I believe in to-day and the work I am doing, in to-morrow and the work I hope to do, and in the sure reward which the future holds.

"I believe in courtesy, in kindness, in generosity, in good cheer, in friendship and honest competition.

"I believe there is an order somewhere for every man ready to take one.

"I believe I am ready—right now."

## Christmas Display in Central-Station Office.

In one of the show windows of the Manchester Traction, Light & Power Company's office on Hanover Street, Manchester, N. H., is a very attractive Christmas setting arranged by the office staff. Among the features of the window display is a disappearing electric sign formed of tiny incandescent lamps, set in a background of evergreen, and showing the holiday motto, "Merry Christmas and a Happy New Year." As it operates the lamps are all extinguished and then flashed on again, one letter at a time, until the complete motto is shown in dazzling letters. The lamps are then extinguished, and one complete word at a time is lighted. After being once more extinguished the entire seven words flash out at once. The mechanism for operating the sign was devised by H. G. Sargent, of the company's electrical department. In the basement is a large wooden cylinder, caused to revolve slowly by means of a small motor. In a frame above the cylinder are 30 brushes ½ in. wide, set so that the ends sweep the cylinder as it revolves. Each brush is connected with one of the letters in the sign above, and the circuit is formed through brass plates set on the face of the cylinder. The device thus resembles the ordinary flashers on the market.

The window in which the disappearing sign is shown has its floor carpeted with pine needles, and in the center is a clearing surrounded by a forest of miniature fir trees. In the clearing stands a picturesque log cabin, with a hunter peering from the open door as if slipping out for a shot at a miniature deer shown among the fir trees. The whole setting is one which is particularly appropriate at this time, since the deer-shooting season in New Hampshire has just begun. The other show window of the company's office contains a setting appropriate to the Yuletide season, and suggestive of the beautiful home decorations possible with the aid of electric illumination. The window is decorated and carpeted with evergreen, and in the center is a Christmas tree about 6 ft. high, richly decorated with chains of popcorn and tinsel, and with many tiny electric lamps of various hues glimmering amid the branches. The display has proved very attractive, and as a result many persons have visited the company's offices for the purpose of purchasing holiday gifts from the numerous household devices and other electrical novelties on display.

## Shutting Down Gas-Engine Plants in Brooklyn.

The power engineering branch of the sales department of the Edison Illuminating Company, of Brooklyn, has in the four months ending Nov. 30 succeeded in dismantling 38 isolated power plants operated by gas engines. The engine units were rated all the way from 2 hp up to as high as 40 hp, and were located in machine shops, bakeries, small mills, tailor shops and similar mercantile establishments. Probably the greatest factor in shutting down these gas-engine plants is the maximum demand power contract now offered in Brooklyn to motor users. The rates on this contract are as follows: Ten cents per kw-hour for the first 25 hours per month use of the maximum demand; 5 cents per kw-hour for the second 25 hours per month use, and 3 cents per kw-hour for all energy furnished in excess of 50 hours per month use of the maximum demand. Whenever the portion of the bill which is figured at 3 cents per kw-hour exceeds $25, the discount on such portion is 5 per cent; 10 per cent is allowed when the amount is $50; 20 per cent when it is $200; 40 per cent when it is $400, and 50 per cent when it is $1,000 and over. Intermediate discounts are determined by interpolation.

The term maximum demand as used in the contract is construed to mean the maximum kilowatts used at any one time during the period covered by a bill for electricity, as determined by assuming the maximum demand to be equal to a percentage of the capacity in horse-power of motors installed, as indicated by the manufacturers standard nominal rates, such percentage varying according to the following schedule: Installation under 10 hp where only one motor is used, 85 per cent; installations under 10 hp where more than one motor is used, 75 per cent; installations from 10 hp to 50 hp, both inclusive, irrespective of the number of motors, 65 per cent; installations over 50 hp, irrespective of the number of motors, 55 per cent. In consideration of the expense incurred by the

company in connecting its mains with this equipment, and the special rate and terms specified, the consumer agrees to pay the company each month during the term of the agreement not less than $1 per month per horse-power or fraction thereof in rated capacity of motor or motors connected, such charge, however, to be not less than $2 per month. Motors are of a type approved by the company.

A comparison of costs from the use of electricity for motors under this contract to that of gas engines, using illuminating gas costing 80 cents per 1000 cu. ft., shows that the electrically driven shop is as economical as one driven from gas engines. It further permits the owner to use small quantities of electricity as against the necessity for running a gas engine at practically constant speed, whether or not a load is being carried. The liability of fire with the use of the gas engine, together with its obnoxious odor, noise of gas explosion and the expensive piping (necessary according to Fire Underwriters' rules) to carry the products of combustion to the external air, have all proved talking points of value to the Edison solicitor. In the larger units the inability of the gas engine to operate elevators and similar machines requiring high starting torque has been a point in favor of electric service. The Brooklyn Edison Company is compiling a book of testimonials from satisfied customers who have replaced gas engines by electric motors.

## Straightening a British Load Curve.

BY GLENN MARSTON.

CARLISLE is situated on the west coast of England close to the Scottish border, has a population of 50,000, and has such railway connections as make it a good manufacturing town. The city owns the gas and electric supply business and does not permit any active competition between the two, influence having until recently been exerted in favor of gas.

The present manager is Mr. S. T. Allen, who has been in charge of the station for about a year. Mr. Allen's predecessor had allowed the electric department to work out its development along the lines of least resistance—pithily expressed to the writer by the Town Clerk, who said: "We have a monopoly of the gas and electric supply. Therefore if anybody wants either service they must come to us, and it has been unnecessary for us to exert ourselves."

This is the attitude of the city authorities at the present time, and Mr. Allen has had to do what he has done in the face of complacent satisfaction on the part of councilmen and deep-rooted prejudice in favor of gas—gas having been longer in use and therefore worthy of greater respect.

Mr. Allen found a load curve resembling a cross-section of the Isthmus of Panama, and asked for permission to employ canvassers, which permission was refused as an unnecessary expense. Therefore Mr. Allen took matters into his own hands. He found a day load of 80 hp, with a peak of about 1,200 hp. At the same time the peak began to fall off through the advent of tungsten lamps. His load curve was flattening, but it was a doubtful blessing, as his departmental purse was flattening out at the same time.

He was one of the first of the few British managers to realize that hostility to tungstens would not prevent their introduction, and while he did not try to secure the use of higher candle-power lamps among his existing consumers he made a successful effort to secure new customers in order to offset the drop in lighting load caused by the tungsten lamps. At the end of the year, therefore, Mr. Allen was able to report no decrease in energy consumption, no increase in peak load, and a decided increase in the number of consumers.

While fighting single-handed to keep up his lighting load he was devising means for increasing the day load. The city of Carlisle issues a pamphlet entitled "Aspects of the City as an Industrial Center," but seemingly does not realize the full value of cheap electric energy as an asset, for it is not given half a dozen lines of consideration in the whole pamphlet, yet this pamphlet was handed to the writer by a city official as giving full information regarding electric service in Carlisle. On one page it says: "These advantages may be stated to be: (*a*) Its abundant water-power and available supply of electricity or gas for power purposes at reasonable rates," and, 12 pages further on, "Mains for the supply of electricity are laid throughout the city, and the corporation [the municipality] is in a position to supply energy to any new industry at prices which will compare in every way favorably with those offered elsewhere."

When Mr. Allen wanted a canvasser for motor service he was told that this pamphlet could be used to advantage. Here was an 80-hp day load, and a peak 15 times as high, with seven lines in a pamphlet recommended as a remedy! Mr. Allen had no elaborate calculations of what other motor users were paying, for there were no other motor users.

He secured the adoption of a new rate schedule increasing the cost of electricity for lamps and decreasing the cost for motors. In order to make the motor-service rate assist in filling the gap, 1,288 hours a year are restricted and a higher rate, more than double the off-peak rate, is charged. The present rates in Carlisle are as follows: Straight meter rate for lighting, without consideration of maximum demand, 10 cents per kw-hour; maximum demand, $35 per year per kilowatt of demand, plus 4 cents per kw-hour for energy. In commercial lighting the rate is 5 cents per kw-hour during the restricted hours. All motor users are supplied with two-rate meters governed by a time switch. The off-peak rate is 2 cents per kw-hour except during the restricted hours, when it jumps to 4½ cents. The restricted hours apply to afternoons and evenings from October to March; at other times only the 2-cent rate applies. Special rates are given to large users, but all contracts contain the restricted-hour conditions.

By constant personal solicitation Mr. Allen has in the past year increased the motor load from 80 hp to over 650 hp. One large customer has taken 100 hp and sold his steam plant outright. Mr. Allen's chief efforts have been directed toward the large users, from 25 hp up, on the assumption that the efforts expended on these prospective customers must become known to small motor users, and that they will be influenced to a large extent by the adoption or rejection of electric motor service among the leading industries. For example, the adoption of motors on the coal docks led to the installation of electrical equipment in several engineering works, and results are directly traceable to these installations in several cases where small machine shops have become motor users. A year ago there was not a single textile mill using electric motors, while to-day many minor details are taken care of by motors.

The situation in Carlisle is best summed up by Mr. Allen himself: "We needed motor business, and there was nobody but myself to get it. I found it took just as much argument to get a small consumer as a large one, and that many small ones followed the lead of the principal manufacturers. Our load is nothing to boast of, but I feel that it will not be long before I can convince the Council that canvassers for motor service are worth while."

## Educating the Chinese in Things Electrical.

In every large city there are quite a number of Chinese laundrymen whose patronage is considerable. It is characteristic of their race that they work long hours and work steadily. For some reason or other the central-station companies have given little attention to developing business among these laundrymen, and in this connection it is interesting to note the campaign of education promulgated by the Edison Electric Illuminating Company, of Brooklyn, N. Y. This company realized at the outset that it is a difficult matter to wean a Chinaman away from ancient methods of performing his work, but, having found one progressive Oriental who could grasp the possibilities of equipping his shop with electrical apparatus, the Edison Company now appeals to other laundrymen in the city in their native language.

Fig. 1 herewith shows an electric washing machine located

in a Brooklyn laundry, which, in addition to being lighted with electricity, is also equipped with electric irons, so that washing

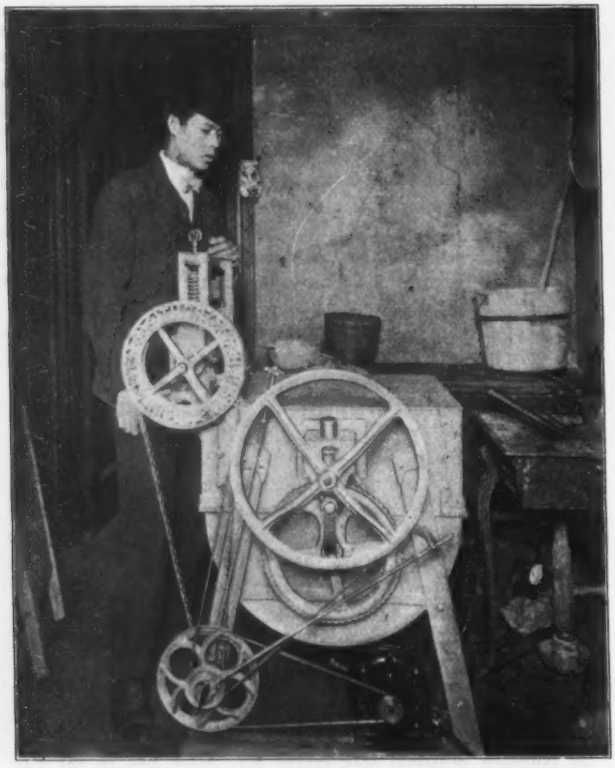


FIG. 1.—ELECTRIC WASHING MACHINE IN CHINESE LAUNDRY.

and ironing operations can be carried on simultaneously. The washing machine does not require the constant attention of the

FIG. 2.—ELECTRIC LAUNDRY CIRCULAR IN CHINESE.

Chinaman, and by means of the electric irons unnecessary steps are saved in traveling to and fro from the stove heretofore used, and which is usually located in a back room.

Fig. 2 shows the communication sent to every Chinese laundry in the city. The circular is headed "The Electric Laundry," and a Chinaman ordinarily receives so little mail, outside of personal letters, addressed to him in Chinese characters, that the letter is bound to receive attention. The interpretation of the characters is as follows: "Chinamen can work harder, longer, than any other. But there are machines than can work harder, faster, better than even Chinamen—and cheaper, too. One of these is a washing machine. Does ordinary family wash in an hour. Gets the clothes clean without tearing them and without use of injurious acid. Is particularly fitted for laundry work, being so steady, reliable, swift and tireless. Any laundry that is electric lighted can have this great money-making washing machine. For it uses the electric light current. Cost of putting it in with electric light will be about $100. After that it will cost only about 1 cent per hour. Draws no wages, eats nothing. You can see it at our salesrooms, 380 Pearl Street, Brooklyn, or you can see it doing all the work at Tom Jung Hoy's laundry, 5510 Fifth Avenue, Brooklyn. Tom Jung Hoy is a bright Chinaman who does not believe in killing himself with hard work when electricity will do it for him cheaper and better than he can do it for himself; and give him the best light in the world at the same time. And also increase his business by making his neighbors think well of him. Americans know that electricity is good. When they see a Chinaman using electricity they say: 'That's a wise Chinaman. He knows what is best. He does good work. I want him to work for me.' The electric laundry is the best. We will make it for you. Come to us bringing this paper or write us a post card telling where to call on you."

The letter is signed with the name of the company, and gives the addresses of its various offices. Inasmuch as the laundryman would be a long-hour user, it is expected that a profitable load will be acquired as a result of the campaign.

## The Selection of Stationary Motors.

By S. H. Sharpsteen.

ELECTRIC motor salesmen and engineers often find it difficult to select motors of the proper rating to drive the various machines that come up for consideration. In one case a certain engineer looked over the machinery of a shop that was fitting up structural steel for building purposes and secured data, for a contractor, on which to base an estimate for individual electric motors. A contract was awarded to another company that bid on the same make of motor, but agreed to do the work with smaller sizes. For example, a 5-hp motor was guaranteed to do the work where the first contractor had recommended one of 7.5 hp. The purchaser, according to agreement, constructed metal bases from drawings, furnished by the successful bidder, on which the motors were bolted and geared to the cutting-off machines. When the motors were placed in service it was found that although they were practically of the same rated output as the small individual steam engines that formerly did the work, yet after a cut was made the fuses would blow before the motors could get the speed of the cutting-off tools to a rate that would allow the motors to stop the excessive flow of current. Larger motors and motor bases had to be installed before the equipment would be accepted.

The above was a case of the motor first driving a heavy wheel, the momentum of the wheel and the motor combined later forcing the cutting-off tool through the structural steel. While the tool was going through the steel much more power was required than the full-load output of the motor, and more power than could be supplied by the motor and wheel combined to keep the speed sufficiently high to prevent the fuses from blowing.

When the engine was being used it would slow down with the flywheel while the cut was being made and later would accelerate the flywheel without causing any perceptibly bad results.

If the motors had been belted, with leather belts, the motor

pulleys might have been able to creep under the belt sufficiently, just at the time of cutting, to save the high-current peak, but the gear compelled the motor to run at a speed having a fixed ratio to that of the cutting-off machine.

In cases of the above kind the salesman should be careful in applying the information given by manufacturers who have no record of the operation of their machines driven with individual electric motors.

The elevator, dumb-waiter, and other hoisting apparatus deserve special attention on the part of the persons selling electrical apparatus in order to meet successfully the competitor's price and at the same time to have the motors work properly when orders are secured for them. Since the motors used for this kind of work have such intermittent runs and are idle much of the time, it is customary to rate them specially for the work. If a prospective buyer states that 10 hp will be required to lift a loaded elevator car, for which he wants a motor, one salesman might bid on a 10-hp motor, constant running, with full-load rating, and another salesman on a 7.5-hp or even a 5-hp motor rated for constant running service. Either of the motors might do the work, but one would be higher in price compared to the others. One make of motor may withstand a very high rating for this kind of work while another one, running successfully doing various other kinds of driving, would fail to give good results, as has been proved in practice.

When the elevator people commenced the use of motors of high rating, series windings were employed to excess. The result was a varying elevator running speed. If the counterweights were sufficiently heavy to more than balance the weight of the empty car, there should be a very light load on the motor, consequently a small amount of current passing through the series winding, and as it is usual to make series field coils a part of the normal field windings, the car speed would be much above normal while ascending with the attendant only, and when descending with a very heavy load the motor might be driven as a generator, thereby sending a current in the reverse direction through the series field coils and allowing the motor and elevator to run at an excessively high speed.

In a case of the latter kind in New York City an elevator contractor disconnected the series field coils and coupled the shunt windings in multiple, thereby obtaining a much more uniform speed; but field coils working under such conditions would soon give trouble if left in circuit for much of the time.

In some cases the motor field coils are used in multiple at start, and as the car is brought to speed, they are placed in series by the elevator controller. This answers the purpose of the series field coils for start and produces a more uniform running speed. In the change from multiple to series connection of the field coils for this purpose, it might, in some cases, be necessary to use resistance in connection with the field winding to prevent too sudden speed increase.

When the electric generating plants in the navy yards were small the naval specifications for elevator work were drawn to insure a current inrush decreased as much as possible, and they show in what respect trying to avoid one trouble may lead to another.

Several firms were awarded contracts for buildings, each building to have an elevator for freight purposes. In one case the elevator was reported as not complying with the requirements of the naval specifications. On investigation it was found that the other elevators were equipped with high-speed motors having much series field excitation, and would start in the specified time with allowable current inrush and a maximum four-ton load, but would descend with much increased speed with the maximum load.

The equipment that was rejected had a large slow-speed motor, would take a few seconds longer to start after the switch was closed and with the four-ton load would allow a larger current inrush than the specifications allowed, but would move at about the same speed regardless of the load or the direction of running.

When the facts were carefully placed before the officer in charge of the yard the equipment that was formerly not approved was accepted.

When induction motors are installed to operate elevators and hoists, especially when they are placed more than 50 ft. from the street or generator, care should be taken to use sufficient conductivity in the service wires, or the individual circuits, running to the motors, in order to minimize the $I^2R$ losses while the motors are starting. A certain manufacturing company near New York City installed a 12-hp, three-phase induction motor to operate a dock hoist. The generator supplying the energy was of 50-kw rating. The motor was placed approximately 700 ft. from the switchboard, the copper in the circuit being of about the same cross-section that would be used to supply energy for a direct-current machine of the same size for constant running. The low power factor of the motor when starting under load caused so much loss of energy in the circuit that the load was excessive on the generating apparatus, even when no other motors were running.

The alternating-current generator was of a type that would maintain the proper voltage as long as the speed did not decrease too much and the engine, which had a shaft governor, was sufficiently large for the generator.

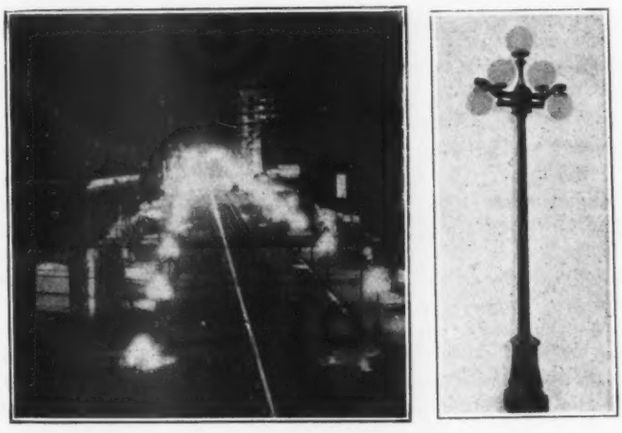
When the copper in the circuit was increased to about three times its former cross-section, the engine governor ceased knocking during the time the hoist was in use and the whole plant could be operated at one time.

# INTERIOR WIRING AND ILLUMINATION

## Seattle Street Lighting.

On account of their high efficiency tungsten lamps are being employed with considerable satisfaction for street lighting where carbon incandescent lamps would prove too expensive in operation and arc lamps would have been used previously. The substitution of incandescent for arc lamps permits of the use of street lighting fixtures much more artistic and desirable from an esthetic point of view than are commonly associated with street arc lamps.

One of the most impressive equipments for tungsten street

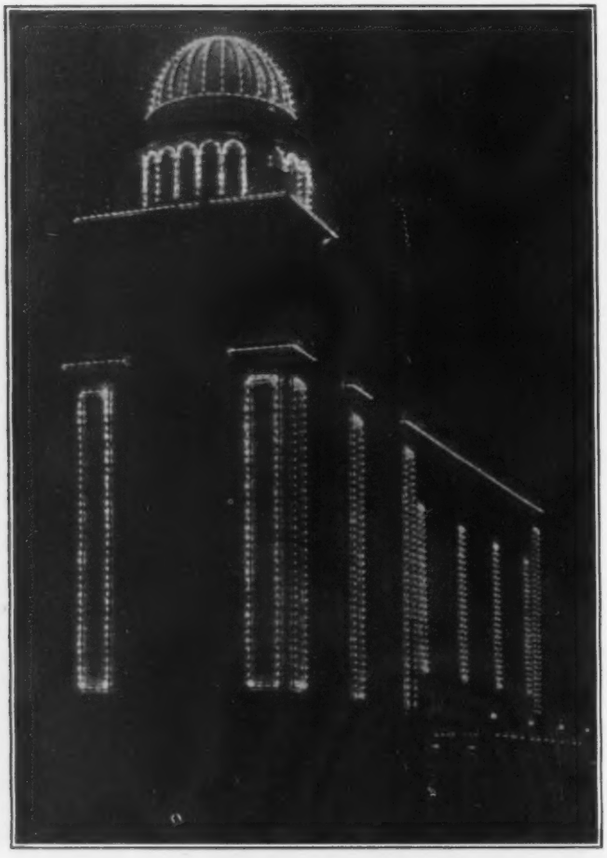


FIGS 1 AND 2.—SEATTLE STREET LIGHTING.

lighting is to be found at Seattle, along Third Avenue, where the sidewalks are lined with graceful electroliers spaced at such frequent intervals as to provide almost uniform illumination, as will be noted from Fig. 1. A view of one of the electroliers, showing the arrangements of the lamps and frosted globes, is given in Fig. 2. The top ball contains one 100-watt lamp, and each of the other four is equipped with a 60-watt lamp.

## Illumination of the Denver, Colorado, Auditorium.

The Auditorium in Denver, which is owned by the city, is one of the best known public buildings in that place. In 1908 it was used for the Democratic national convention and in 1909 it served for housing the recent convention and exhibition of the American Street & Interurban Railway Association. A night view of this building showing the incandescent lamps used for outlining the architectural features is shown in the illustration herewith.



DENVER AUDITORIUM BY NIGHT.

The building is equipped with its own isolated heating and electric service plant, but an emergency connection with lines of the Denver Gas & Electric Company is also provided. The equipment consists of Babcock & Wilcox boilers, Ideal engines and Northwestern direct-current generators. Two of the generating sets consist of engines directly connected to 125-kw, 220-volt lighting machines, while a third is a 60-kw, 500-volt set for supplying energy to motors.

The building is lighted with 16-cp incandescent lamps throughout. There are 14 "sunbursts" for general illumination on the ceiling, each containing 96 lamps. In addition, the galleries are outlined and there are ample facilities for stage lighting and other lighting wherever needed.

When arranged as a convention hall 12,500 people can be seated comfortably. By means of electric motors the hall can be transformed within an hour into a theater capable of seating 4000 people. Portions of the balconies are arranged to run on tracks and turn on a pivot, so that they can be moved into the hall or pulled back against the wall by a 10-hp motor operating a winding drum and an endless cable. The proscenium arch and the two pedestals on which it rests are lifted into and lowered from the rigging loft by three separate motors by means of steel cables.

## Equipment of a Model Electrical Home.

A model electrical home recently opened by the South Metropolitan Electric Light & Power Company at Catford, England, is of interest both by reason of the scheme used for wiring and on account of the electrical devices placed in service. The circuits in the building have been arranged in two divisions, one of which is operated at 50 volts and the other at 200 volts. The power is in the rear portion of the house, where electric cooking is carried on and low-candle-power lamps are used. For this circuit use is made of neat open wiring, to which energy is supplied through a transformer. In the main portion of the house use is made of concealed wiring operated at the usual supply e.m.f. of 200 volts.

In the house every domestic operation, so far as possible, is carried out electrically. In addition to the usual lighting fixtures the hall is provided with an electric clock, a telephone, an electric hat pad and a cigar lighter. The library is provided with portable lamps, fans, radiator and a telephone. In the dining room are electric tea urns and hot-water jugs, electric candlesticks, radiator and a telephone. In the kitchen are two electric ovens, cookers, grills, hot plates, irons, water heaters and knife cleaners. The bathroom contains a water heater and a room heater. In the bedrooms are curling-tong heaters and hair dryers, illuminated watch stands and devices for reflecting the time upon the ceiling during the hours of darkness. The home is provided with a motor-driven vacuum cleaner, a sewing machine and shoe-shining machine.

The lighting throughout is accomplished by means of metal-filament lamps. The fittings have been chosen to harmonize with the styles of decoration, and comprise a variety of pendants, brackets, floor and table standards.

## Technical Knowledge of the Wiring Contractor.

A recent issue of our London contemporary, *The Electrical Field*, contains an article by Mr. W. Perren Maycock, outlining the scope of the technical knowledge which a wiring contractor should possess. In discussing wiring, he stated that a very intimate acquaintance with the various systems of wiring and their respective mechanical and electrical advantages is necessary. What is proper for one class of premises will not necessarily be proper for another, and in any given installation different systems may be combined with advantage. The wide choice of systems for use in factories should be studied, and the advantages and disadvantages of lead-covered wire should be known. The cost of wiring is the main item in most installations. It may well be said that the safest of all wiring systems is that in which the wires are run in insulation-lined iron conduit, but by reason of the prohibitive cost, this system can be used only where money is plentiful. All other systems may be said to be less safe, and the problem is to determine how far safety may be sacrificed to cheapness. The margin of safety may, indeed, be decreased a good deal more than is supposed, for after all, the safety of the cheapest system is much greater than that of gas lamps, oil lamps and candles. The question of safety from fire-risk is mainly the bogey of the insurance companies, which seem to lose all sense of proportion when they distinguish between electricity and gas. They seldom understand that the use of electricity under any practical conditions should be a matter of far less worry to them than, say, a naked gas jet and the extensive use of matches.

In regard to lamps, it should be remembered that there are at least eight different types of lamp available—open and enclosed arcs with pure carbon electrodes; open and enclosed flame arcs, mercury-vapor, and metal, carbon, and Nernst filament lamps. The metal lamp and the open-type flame arc are, of course, by far the most extensively used, but each of the other types has its advantages for certain situations. If colors are to be diminished, flame arcs and mercury

lamps are useless, and it is necessary to fall back upon the old open or enclosed pure-carbon arc lamp. The enclosed flame arc is new, but has probably come to stay. Mercury-vapor lamps deserve more notice, as they give a better diffused light than any other. Their main drawback is the peculiar tint of the light, which prohibits their use where color work is done. But for offices of all descriptions, places such as watchmakers' shops, where small detail work is in progress, and small and even large workshops, they are extremely suitable. They have even been installed with success in such places as foundries and breweries, where the mechanism of arc lamps is apt to suffer. The Nernst lamp, although it labors under certain well-known disadvantages, possesses a distinctly soft mellow light, and it is only slightly less efficient than the best metal lamps.

A knowledge of the efficiency values of the various types of lamp is of the utmost importance. Though carbon lamps are the least efficient, it is often more economical in the long run to instal these in preference to the higher-priced metal lamps in places where light is required only at intervals. The mechanical as well as the electrical knowledge of the contractor has plenty of room for scope in discriminating between the numerous new makes of arc lamp on the market. Of course the dearest lamp is not necessarily the best designed, but most certainly the cheaper makes are to be avoided. It would pay a large contractor to buy a sample of every promising new lamp as it came out, and give careful study to its mechanism and working. Photometric measurements on arc lamps might present some difficulty, but certainly the contractor should be in a position to make tests of his own of the efficiency and life of incandescent lamps. Arc lamp accessories, such as auto-transformers, resistors, hoisting gear, and so forth, require more attention, and their details should be the subject of special study.

The choice of incandescent lamp fittings should be governed by considerations of utility and harmony. As much care is necessary in selecting fittings for a workshop as for a drawing-room. Fittings of all kinds, however plain, should be well made; important details, such as ease of wiring, safety of wires, smooth working of counter-weights, etc., should be seen to. It may be too much to expect every contractor to possess great artistic perception, but this is something to be cultivated. It is true the customer generally has most to say in this matter, but as he is usually confronted with a bewildering array of designs when the time comes to select fittings he naturally expects some help from the contractor. The electrolier should be used with discretion; it is not necessary to follow slavishly in the wake of the gasolier. Counter-weight and fixed pendants, ceiling fittings, brackets, and portable table standards are generally preferable in small houses. Shops, shop windows, and workshops require special treatment.

Special attention should be paid to the arrangement of switches and circuits. The two-way switch does not represent the limit of things. Many convenient schemes may be utilized by employing double, intermediate, three-way, series-parallel and certain other ingenious switches, some of which are combined with plug connections.

The arrangement of the lamps requires the most careful consideration, and determines in great measure the types of fittings to be employed. The shading of the lamps is an even more important matter. It is safe to say that three-fourths of shop-window lighting is unsatisfactory and here special attention is required.

There are now on the market a number of different heating systems and appliances. Although electric heating is sure to make headway, some of the methods of obtaining and utilizing it will certainly not survive, and it would be unwise for any contractor to pin his faith to a particular system without first comparing it with all others. In fact, a close study of the generation and application of electric heat to utensils of various descriptions is extremely desirable.

The lamp radiator has proved its right to rank as a practical article, but much depends on the make both of lamp and frame.

## New Telephone Patents.

### IMPROVED SWITCHBOARDS.

It sometimes happens that a telephone switchboard must be installed where the conditions are such that a magneto system is alone economical at the time, and it is reasonably sure that before the switchboard has served its life, a change to a central energy system will be warranted. It is for such conditions that Mr. C. S. Winston, of Chicago, Ill., has devised the switchboard described in a recent patent granted to him; this patent is assigned to the Kellogg Switchboard & Supply Company. In this switchboard the apparatus is so designed that it will operate satisfactorily on either system. The wiring is so arranged as to be convertible by bringing it out at all points of

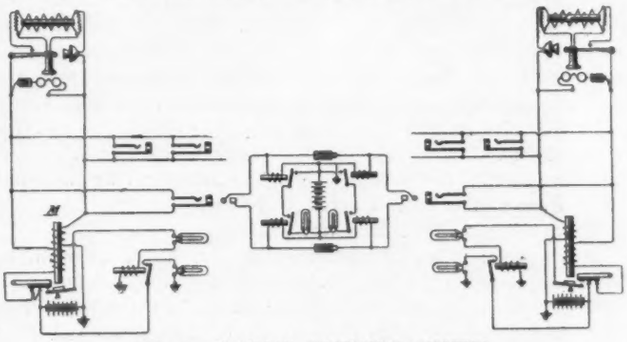


FIG. 1.—MANSON EXCHANGE SYSTEM.

difference to lugs at which all necessary connections may be made to effect a change from one system to the other.

Mr. R. H. Manson, of Elyria, Ohio, has patented a switchboard whose circuit system is shown in Fig. 1. It will be seen that the jacks are of the two-wire type. The double-wound cut-off relay is of the two-stage type. Under the influence of current through the subscriber's line and instrument, it operates its first stage and closes the lamp circuits. Under influence of current from the plug or cord circuit, it operates further to sever the lamp circuits, and to open one of its own windings. It remains in this condition until the plug is removed from the jack.

### TELEPHONE SYSTEM FOR AUDITORIUMS.

Under this title Mr. K. M. Turner, of New York City, has patented a telephone system comprising numerous receivers scattered throughout the space to be occupied by listeners; several transmitters scattered about more distantly and arranged so that one will always be within fairly close range of any chance speaker from the audience and a switching apparatus presided over by an operator. This latter observes the location of the speaker and switches into the circuit one or more neighboring transmitters. By listening, the operator determines when the best effect in the listening circuit has been secured.

### "TELL-TALE" FOR RURAL LINES.

On rural lines, with their many stations, there always arises the suspicion of someone listening-in on one's conversation. This practice varies greatly in different localities, being particularly indulged in, however, wherever the telephone service is a novelty.

All sorts of schemes have been invented to overcome its possibility, but these generally were so cumbersome as to introduce troubles far outweighing the difficulty sought to be overcome, and troubles lasting long after the novelty of the service has worn off. Most of these preventives have taken the form of lock-out and selective devices, but Mr. T. W. Ralph, of North Augusta, Ont., has now invented what may be termed a "tell-tale" system.

A tilting track is attached to the hook lever at each station, so that it has a reverse inclination when the receiver is off or upon the hook. As the inclination reverses, a cylinder rolls down the plane, closing a circuit at intervals and sending out such a code of signals upon the lines that the interfering station may be at once identified. A latch device is arranged so

that this signal cannot be distorted, the hook being locked after rising until released by the roll reaching the end of its travel.

ADJUSTABLE RECEIVER.

For wireless telephony Mr. F. G. Sargent, of Westford, Mass., has patented an adjustable receiver. The coil has several intermediate terminals brought out, each of which terminates in a plug socket imbedded in the shell. One cord strand ends in a plug which may be inserted in any socket which will give the best results.

TRANSMITTER.

Mr. W. W. Dean, of Elyria, Ohio, has obtained the reissue of a patent describing an inverted solid-back type of transmitter. The cylindrical granule box is secured to the rear electrode through the usual mica washer, this rear electrode in turn being secured through its spindle to the bridge piece. A pair of springs extending from the bridge bear upon the granule box in a way to push it from the bridge. In assembling, the diaphragm receives the base of the microphone button at its center, the above-mentioned springs insuring the contact. It will, therefore, be seen that the maximum amplitude of vibration of the diaphragm is transmitted to the button, no matter at what particular point of the contact it occurs. Mr. Dean has assigned his patent to the Dean Electric Company.

AUTOMATIC SYSTEMS.

Three patents have been issued to Mr. E. E. Clement, of Washington, D. C., which he has assigned to the North Electric Company. These all relate to a method of arranging lines and apparatus to simplify the selection of the one desired. For example, in Fig. 2, are indicated by the upper left-hand row of arrows 10 lines numbered, say, 1 to 10. Next below are lines 11 to 20, and then lines 21 to 30. The energization of the magnet of any group serves to close the contacts to connect all 10 lines of the group to multiple extension wires, with each one of which a units relay is associated. Looking now at the machine

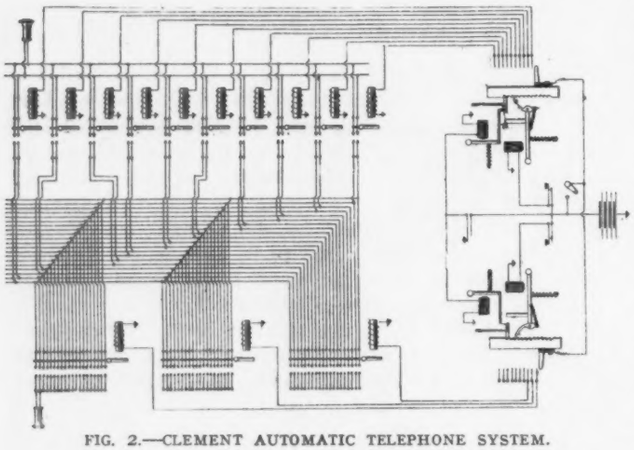


FIG. 2.—CLEMENT AUTOMATIC TELEPHONE SYSTEM.

shown at the bottom, it will be appreciated that each vertical step of the bar at the left selects a corresponding tens group, while each step of the right-hand part corresponds to a unit. Thus, two left and five right cut the tens group 21-30 on the subconductor system and then operate the fifth unit relay to connect No. 25 to the common wire of the units set. Thus 13 relays select any one of 30 lines and, continuing to 100 lines, require but 20 relays.

Mr. C. L. Zahm, of Los Angeles, Cal., has patented a system in which manual and automatic working are combined. The calling station is provided with selecting sending keys. By manipulating these in a prescribed manner, a first and second selector of the Strowger type are caused to operate in a manner to connect the calling line to a manual switchboard trunk and to display a signal for attention. By certain other manipulation the desired lines may be directly connected, the second selector reaching a connecting switch to do this. The subscriber's line thus connected may, of course, also terminate on the manual switchboard. The user thus has a choice of operating method.

# Letters to the Editor.

## Design of Illuminating Installations, Using Luminous Tubes.

*To the Editor of Electrical World:*

Sir:—I beg to point out that the article by M. D. Cooper in your issue of Sept. 23, entitled "Design of Illuminating Installations Using Luminous Tubes," is anticipated, so far as relates to its equations of illumination and photometry of lamps, by an article by the writer entitled "Beleuchtungs Berechnungen für Quecksilberdampflampen II," printed in the issue of Sept. 10, 1908, of the *Elektrotechnische Zeitschrift*. An abstract of my article was given in your Digest of Oct. 3, 1908, page 753. I shall be glad if you will give publicity to these facts relating to priority of publication.

Berlin, Germany. Konrad Norden.

## Patent Reform and Engineering Societies.

*To the Editor of Electrical World:*

Sir:—The letter in your issue of Dec. 9 by Mr. Ludwig Gutmann, under the heading "The Patent System and Its Relation to Industrial Development," presents a very able statement of the present patent situation, which statement seems to me worthy of more than passing consideration, not only by individuals but also by technical and other societies. Mr. Gutmann is perfectly right when he says that concerted action by societies is necessary to bring matters of this kind to the attention of Congress, and his warning that inaction in this respect will prove a short-sighted policy should be taken very seriously.

It is true that the patent laws of this country were made "sporadically," there being as a consequence "no system or order about them." I agree, therefore, with Mr. Gutmann that the patent laws of this country should be thoroughly revised and new laws should be enacted to remedy the defects of the present system, some of which defects have repeatedly been made the subject of discussion in your paper.

One of the chief defects of the present patent laws of this country seems to me to consist in the absence of any enactment providing for the punishment of infringers where the infringement is committed with full knowledge of existing patents covering the invention which is being infringed.

With the exception of the United States, England and its colonies, including Canada and Australia, the patent laws of practically all countries make infringement a criminal offence when the infringement is committed with the intent and knowledge of infringing, or by gross carelessness on the part of the infringer when he can be supposed to have had knowledge of existing patent rights which he infringes in using a patented invention. Where the criminal intent of the infringer can be proved, or gross negligence on his part shown, the penalty imposed by the courts may consist in a heavy fine or imprisonment, or both, and confiscation of the articles which represent the patented invention. In addition to the fine imposed by the court, the infringer may be made the defendant in a civil suit for damages. Besides, the complainant is usually given the right to publish, at the cost of the infringer, the sentence of the court.

If such provisions were embodied in our patent laws, I believe that much of the evil that now exists under the present system would be eradicated, for individuals as well as corporations would be less hasty in using inventions protected by patents to another, and would show more consideration for the rights conveyed by a patent. If the Government gives to a patentee the exclusive right to the use of his invention, it should also stand behind the patentee in sufficiently protecting him against the unauthorized use of his patented invention by others. The wilful infringement of a patented invention is worse than theft, or even robbery, for the reason that it is not always easy for a patentee to discover the infringement; the infringer, who is usually backed by sufficient means, reaps large profits

from another's invention, thereby enriching himself, whereas the inventor, who in many cases is comparatively poor, has no means to stop the continuation of the crime. If a man steals an article, or even commits the crime of robbery or burglary, he does this act once, but the infringer, each time he makes or sells an article patented to another, commits the same crime over and over again. Such an infringer, who knowingly and wilfully uses for his own profit an invention patented to another, is by far worse than a common thief, and it is *extraordinary* indeed that such a crime should go unpunished by the Government.

Mr. Gutmann cites, among others, a case in which a large corporation appropriated to its use the invention of a young inventor, who was unable to stop the criminal practice of said corporation. The latter first had tried to cheat the inventor out of his patent rights by filing an application in the Patent Office for the same invention, but, fortunately for the inventor, he prevailed with his rights, receiving the patent. If our patent laws contained a provision making the wilful infringement of patents punishable by fine and imprisonment, and if such a law were strictly enforced against officers of large corporations, who sometimes make it a practice to infringe patents either openly or covertly, the conditions in this connection so often complained of would certainly soon be changed for the better.

Mr. Gutmann also speaks of the great expense involved in patent litigation, which expenses are incurred by the hiring of experts, lawyers, etc. I would like to point out here that in European countries suits brought against infringers are comparatively inexpensive, since the witnesses' testimony is heard in open court, and accordingly there are no such long delays as occur in this country by the taking of testimony in various parts of the United States and the continual delays thereby caused, and by the printing of the testimony.

One more word about the co-operation of technical and other societies in bringing about a revision of the present patent laws of this country. In the European countries the technical societies play an important rôle when it comes to the revision of patent laws. In bringing about the enactment of the first German patent law, for instance, the Verein Deutscher Ingenieure took a prominent part, and again had its full share in bringing about a revision of the German patent law in 1891, the first German patent law having been enacted in 1877. At present another revision of the German patent law is under consideration, and in the meetings of the branches of the Verein Deutscher Ingenieure, as well as in the annual meetings of the said society, those matters relating to patents and the protection of other industrial rights are discussed at great length and with a good deal of competent knowledge. Associations of manufacturers, as well as the Chemical Society of Germany and the Association of Electrical Engineers, also take active part in discussing the defects in the present law and the reforms to cure such defects. The same is true of other countries, as, for instance, France, where also the present patent law will be revised in the near future. In Austria, Switzerland and the Scandinavian countries there is always to be found a lively co-operation of societies to bring matters of this kind before the legislature of their country and urge remedial legislation where existing defects have shown that such legislation is needed.

Of course, the United States is a very big country, and many interests of various kinds have to be considered in the enactment of Federal laws; but, as Mr. Guttmann correctly says, action is required, and in spite of the many difficulties met with in introducing bills before Congress and bringing about the enactment of laws, the societies referred to should go to work at once and not wait until, as Mr. Gutmann so well has put it, "we shall drift more and more toward industrial serfdom."

NEW YORK. ALFRED MÜLLER.

# DIGEST OF CURRENT ELECTRICAL LITERATURE

*Abstracts of the important articles appearing in the electrical periodical press of the world*

## Generators, Motors and Transformers.

*Compound Generators in Parallel with Batteries.*—JACOBI.—The author emphasizes that the old idea is no longer justified that parallel operation of compound-wound generators and storage batteries often result in troublesome reversal of polarity of the dynamo. Several systems by which such troubles are avoided are described and illustrated.—*Elek. Anz.*, Nov. 28.

## Lamps and Lighting.

*Metallic-Filament Lamps.*—F. H. R. LAVENDER.—An account of tests in which the author investigated the effect of a change of voltage on the life of metallic-filament lamps. Life curves at different voltages were first determined, and then candle-hour curves. The number of candle-hours obtained from the lamp for a given life could then be read off. From the price of the lamp the "pence per candle-hour per lamp" was constructed, and on the same sheets the consumption curves corresponding to the lamps were plotted. From these the watt-hour curves were obtained, and these, together with the candle-hour curves, gave a curve of the ratio of watt-hours to candle-hours; thus the average specific consumption and, therefore, with a certain price of energy, the cost per candle-hour for any predetermined length of life could be read off. The "total efficiency per candle-hour" curves were plotted for energy at 2d., 4d., 6d. and 8d. per kw-hour. This at once gives the most economical life for the lamp. A set of curves of this description for the tantalum lamp

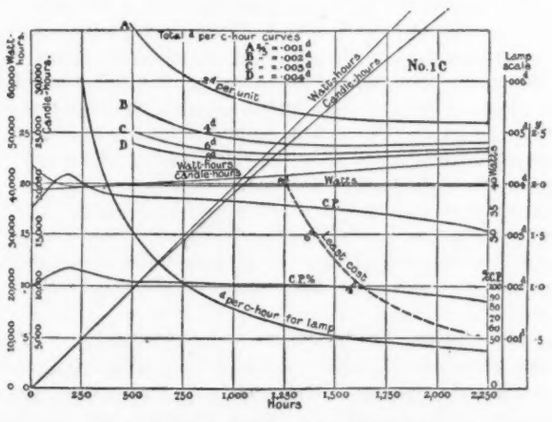



FIG. 1.—LIFE CURVES OF TANTALUM LAMPS.

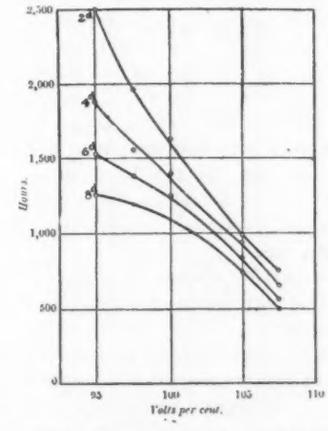



FIG. 2.—LIFE CURVES OF TANTALUM LAMPS.

operating at 100 volts is shown in Fig. 1. The curves in Fig. 2 show how the economical life of tantalum lamps decreases with an increasing voltage. It would seem that increased potential

difference has an effect on the absolute as well as the useful life. The useful life of tungsten lamps is much longer than that of tantalums, though the absolute life may be shorter, owing to the greater fragility of the filament.—Lond. *Electrician*, Dec. 3.

*Radiation from Incandescent Lamps.*—C. Fery and C. Cheneveau.—An account of an experimental investigation of the applicability of the radiation laws for carbon and tungsten lamps. For carbon lamps they found the following relation between the watts $W$ consumed and the absolute temperature $T$ of the filament (measured by means of the optical pyrometer):

$$W = a\,T^4. \quad a = 2.95 \times 10^{-13}.$$

Since this relation is a consequence of the Stefan law of total radiation, it follows that the conduction and convection losses are negligible in this case. For the luminous intensity $I$ as a function of the watts $W$ they find the following relation to hold good within wide limits:

$$I = 2.08 \times 10^6\, e^{-\frac{32.05.}{\sqrt[4]{W}}}$$

For tungsten lamps the corresponding equations were found to be

$$W = a_1\,T^{4.6}. \qquad a_1 = 1.89 \times 10^{-23}$$

and

$$I = 3.08 + 10^6\, e^{-\frac{27.63}{\sqrt[4.6]{W}}}$$

In normal operation the temperature of the filament of the carbon lamp is about 1780 deg. C., that of the tungsten filament is 1875 deg. C.—*Academie des Sciences*, Nov. 8; *La Lumière Elec.*, Nov. 27.

*Arc Lamp Patent.*—A note on an arc lamp patent action in Germany. On Nov. 22 the German Patent Office revoked the German patent No. 186,758, owned by the Deutsche Beck-Bogenlampen Ges. The Regina Bogenlampen Company, of Cologne, had placed a flame-arc lamp on the market under the name of the Conta lamp, in which the tip of the negative electrode rested on a support at the base of the lamp, there being no clockwork feeding gear. The Beck Company alleged that this lamp infringed its patent, which covered this method of supporting the electrodes. As a reply to this the Regina Company applied for the revocation of the patent (apparently on the ground of anticipation), and was successful. In the Conta lamp, which can be used either on alternating-current or direct-current circuits, the negative electrode is placed perpendicularly and the inclined positive electrode is swung for striking and regulating by means of a sliding collar on the base plate, actuated by a series solenoid. The holders of the two electrodes are mechanically connected and feed down as the electrodes are consumed, the tip of the negative electrode resting on a swinging support under the base-plate. This support has an extension upward, which presses against the negative electrode for some few inches above the point. It is so pivoted that when the pressure of the electrode on the lower part is released the upper extension swings away from the electrode and allows it to descend until it again touches the lower part. By supporting the electrode from the side in this way the breakage of the point is avoided. As the arc is some 5 mm distant from the support, the latter does not require frequent renewal. These lamps are stated to run well in series with very even distribution of pressure across the arcs. The same company has also brought out a Conta lamp with an inner prismatic globe, which, being close to the arc and well swept by the air currents, remains free from deposit.—Lond. *Elec. Eng'ing*, Dec. 2.

*Arc Lamps Without Regulating Mechanism.*—R. Hopfelt.—An illustrated article with special reference to the Conta lamp.—*Elek. Anz.*, Nov. 25.

*Arc Lamp Starter.*—An illustrated article on a recent innovation made in the arc lighting system in Glasgow by the introduction of a number of interacting switches, all of which are controlled from a central point situated at the Cathedral Street substation. A small switchboard containing six panels is fixed at this substation, each panel controlling a line of interacting switches (these switches are conveniently termed "starters"), which lights and extinguishes all the arc lamps in a particular district. At present the arc lighting of the city is divided into six districts. The arc lamp starters were designed by J. Fergussen. Their arrangement is described and illustrated.—Lond. *Electrician*, Dec. 3.

*Electric Train Lighting.*—J. Zuendel.—An illustrated description of the new electric train lighting system of Brown, Boveri & Company. The lighting installation of each car is independent and metallic-filament lamps are used. A direct-current shunt generator is geared to one axle of the car and operates in parallel with a storage battery. A regulating mechanism insures that the lamps are always supplied with current at the proper voltage, and that the battery is being properly charged and discharged without being subjected to any undue stresses. The chief object of the battery is to supply energy during the time of stops; its size therefore depends on the number and length of stops. When the train starts the generator is excited—the position of the brushes being adjusted by automatic means according to the direction of the running of the train. With increasing speed the voltage increases. When it has risen to the amount necessary for charging the battery and supplying energy to the lamps, the automatic switch $P$ in Fig. 3 connects the generator with the

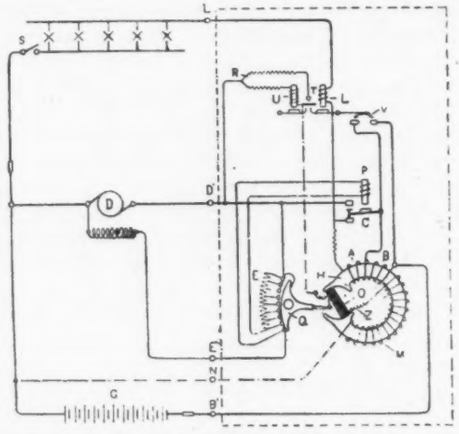



FIG. 3.—DIAGRAM OF TRAIN LIGHTING SYSTEM.

battery and lamp circuit. A further increase of the voltage is prevented by insertion of resistors in the shunt circuit. The resistor coils are marked $E$. The automatic regulation is accomplished by means of the regulator $H$, which slides the contact piece $Q$ over a number of contacts connected with the different portions of the resistor coils $E$. The regulator $H$ is actuated by a magnetic field in which the coil $O$ is placed in a movable position. The magnetic field is produced firstly by a winding, $M$, in shunt with the generator, secondly by the winding $B$, through which the battery current passes. This winding acts in the same sense as $M$. A third winding, $A$, is supplied with the lamp current and acts in a direction opposite to that of $M$ and $B$. The magnetic field produced by the united action of the windings $M$ and $B$ or $M$ and $A$ exerts on the coil $O$ a torque which is counteracted by the action of the spring $Z$, which is so dimensioned that it yields constant torque. Detailed discussions of the action of the regulator under different conditions of the operation are given. The reliability and simplicity of the regulating mechanism is found to be the chief feature of the lighting system.—*Elek. und Masch.* (Vienna), Nov. 28.

*Artificial Illumination.*—L. Gaster.—A continuation of his lectures on modern methods of artificial illumination. The author deals with indirect lighting, photometry, school lighting, lighting of factories and hospitals, etc.—Lond. *Electrician*, Dec. 3.

### Generation, Transmission and Distribution.

*Rolling Mills.*—An account of the discussion in Glasgow of Ablett's recent paper on electric driving of reversing rolling mills. Lamberton, although admitting the advantages of electrical drive for continuous rolling, was skeptical as to the capital expenditure required for an Ilgner installation being justified. T. Mackenzie gave figures to show the saving in costs obtained in a German mill by the adoption of electrical working and the economy in boiler equipment was demonstrated by S. A. Simon.

Some other engineers also spoke.—Lond. *Elec. Eng'ng*, Dec. 2.

*Electric Motors in Textile Mills.*—A comparison of the different methods of variable speed motors for the driving of machines for printing textiles. Direct-current shunt motors, single-phase commutator motors and three-phase variable-speed motors are compared, in favor of the three-phase system, speed variation being obtained by altering the number of poles.—Lond. *Electrician*, Dec. 3.

*Steam Turbine.*—P. ANDRE.—The first parts of an illustrated description of the Barbezat steam turbine, in which an attempt is made to combine the principles of the De Laval and Parsons turbines.—*La Lumière Elec.*, Nov. 20 and 27.

*Draft Regulation.*—An illustrated article giving a brief description (chiefly taken from patent specifications) of recent improvements in devices for the draft regulation of steam boilers.—*Elek. Anz.*, Nov. 18 and 25.

### Traction.

*Single-Phase Traction.*—FREUND.—A continuation of the illustrated serial on single-phase traction on the Hamburg-Blankenese-Ohlsdorf road in Germany. In the present installment a description of the power plant is given. There are seven generators, of which five have a rating each of 1250 kw and give single-phase current at 6300 volts and 25 cycles for traction. A sixth machine of 600 kw gives single-phase current at 6200 volts and 50 cycles for lighting, and a seventh machine of 350 kw gives direct current at 220 volts for driving motors in the station. The alternators are driven by steam turbines running at 1500 r.p.m. For the 1250-kw machines the steam consumption is 8.24 kg per kw-hour and for a 600-kw machine it is 9.7 kg per kw-hour, with steam of 13 atmospheres and 300 deg. C. and a condenser temperature of 25 deg. C. The serial is to be continued.—*Elek. Zeit.*, Dec. 2.

*Argentine.*—A. C. KELLY.—An article, with map, on the very promising conditions at present for electric traction in the Argentine Republic.—Lond. *Eng'ing*, Dec. 3.

### Installations, Systems and Appliances.

*Rates for Lighting.*—An account of the extended discussion which followed the recent paper by Handcock and Dykes, read before the (Brit.) Inst. Elec. Eng. G. Wilkinson agreed with the authors that flat rates are practically doomed. The demand indicator tariff, again, is too complicated for the lay mind to grasp, and it is also expensive. The "contract demand tariff" mentioned by the authors was introduced into Harrowgate in September, 1908. In this case demand indicator consumers paid an average per 30-watt lamp of $1.81 per year, and on the flat rate the average price obtained was also $1.77. It was therefore decided to have a fixed price of $0.68 per quarter, or $2.72 per year per 30-watt lamp, which provided considerable margin on the foregoing average amounts. The basis on which the contract demand tariff was founded was that if a consumer used every lamp contracted for during eight hours every day of the year the supply authority could not lose money on the contract. That, he thought, was surely proof of a sound policy. In the Harrogate agreement the consumer undertook to pay quarterly in advance, to use the electrical energy only on dark days and in the evening, and not to use it in a wasteful manner; also that the energy be used for lighting purposes only, and that the rooms in which the lamps were fixed should not require artificial light during the hours of daylight. These conditions would bear examination and could be easily understood. He had actually removed meters to put installations on that system. A minimum demand of two lamps and a maximum of six are the limits of the contracts at present. A consumer may have 30 lamps in his house, but he cannot use more than he contracted for, because if he does so there will be set up a "blinking" which soon makes his eyes ache. W. R. Cooper thought the most serious objection to the paper of the authors was the suggestion of adopting as low a pressure as 25 volts for the sake of metallic-filament lamps. The objection is that it renders impossible the development of a load from heating or cooking or other domestic uses. Mr. Hirst, as a lamp manufacturer, said it was surprising how the demand is growing for lamps of large candle-power. The high candle-power of metallic-filament lamps had as much to do with their popularity as the actual saving in energy.—Lond. *Electrician*, Dec. 3.

*British Central Station.*—An abstract of the financial report of last year of the Leeds municipal central station; 12,395,118 kw-hours were sold at an average price per unit of 4.04 cents, compared with 12,412,861 kw-hours and 4.38 cents in the previous year. The most marked decrease in revenue is in the sales for private lighting, 5,241,523 kw-hours sold for this purpose producing $365,435, compared with $404,640 obtained in 1907-8 from the sale of 5,771,597 kw-hours. The average price per kw-hour for private lighting in the two years was 6.02 cents and 6.16 cents respectively, while the number of kw-hours sold per 8-hp lamp installed were 19.69 and 21.25, respectively. The sales for motor service show an increase in the number of kw-hours, namely, 6,164,810 kw-hours, compared with 5,746,255 last year, but the resulting revenue is less, namely, $129,555 as against $139,230. The total cost, excluding capital charges, was 1.44 cents per kw-hour sold, while including capital charges it was 3.72 cents.—Lond. *Electrician*, Dec. 3.

*Load Limiting Device.*—A description of a system employed by a British company for keeping the load of a consumer automatically below a certain predetermined value. This system is employed with the current-limit system of charging for energy. The device, as shown in Fig. 4, consists of a resistor and a thermal cut-out mounted on a slab of porcelain and inclosed in

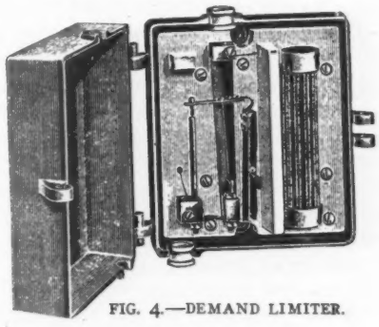


FIG. 4.—DEMAND LIMITER.

a cast-iron case. It is suitable for both alternating-current and direct-current circuits without modification. The thermal cut-out is made of three iron parts—a fixed bar carrying at the upper end a contact spring with adjusting screw, a wire traversed by the main current, and a pillar upon the upper end of which the contact is made. Normally the resistor, which is of the woven-wire type and cylindrical in shape, is short-circuited by the cut-out; when the predetermined limit of consumption is exceeded, even by 20 watts, the expansion of the wire due to its rise of temperature opens the contact and places the resistor in circuit. The resulting diminution of current strength allows the contact to close again, and the lamps therefore continue blinking until the current is decreased.—Lond. *Elec. Review*, Nov. 26.

### Wires, Wiring and Conduits.

*Definition of Constants of Cables.*—A report of the committee of the Berlin Electrical Society, signed by H. Diesselhorst and F. Emde. There have been in the past some difficulties between manufacturers and customers concerning the meaning of certain terms, for instance, whether the capacity of a symmetrical two-conductor cable relates to the voltage between the two conductors or to the voltage against earth, further concerning the exact definition of capacity and inductance of three-phase cables. The present report makes proposals concerning the fundamental definitions and gives formulas for the calculation of capacities and inductances from geometrical dimensions with explanatory notes.—*Elek. Zeit*, Dec. 2.

*Transmission Line Constants.*—A continuation of the tables of transmission line constants. In the present installment the figures of inductive reactance are given for a loop formed by two wires of a three-phase transmission line.—*Gen. Elec. Review*, December.

### Electrophysics and Magnetism.

*Positive Electricity.*—J. J. THOMSON.—A paper in which the author describes various experimental investigations concerning

the nature of positive electricity. The investigation was carried out chiefly with "canal rays" and with "retrograde rays." These were subjected to the influence of various electrostatic and magnetic fields, and the picture obtained from the deflected bundle of rays on a phosphorescent screen was investigated. Some interesting conclusions are being drawn concerning the presence of neutral doublets in the rays.—*Phil. Mag.*, December.

*Uranium and Radium.*—F. Soddy.—The measurements of the amount of radium in the uranium solutions purified and prepared by T. D. Mackenzie have now been in progress for nearly four years, and during the past year have all begun to yield certain evidence of the growth of radium. The quantity of radium in the oldest preparation, which contained 255 grams of uranium, remained almost constant within the error of measurement for the first two years, while in the next year a very slight increase was noticed. During the fourth year the measurements have been made with greater accuracy and have established that the production of radium within this period has been going on at a rate proportional to the square of the time, within the error of measurement. The period of the direct parent of radium calculated from these results, on the assumption that no other intermediate bodies intervene, is 18,500 years in the case of the oldest solution, for which the most complete data are available. But in the solution prepared last the total quantity of radium now present is less than what would have been produced from the radium, assuming the rate of production to have been the same as in the first solution. This suggests the existence of at least one new product, "uranium A," intermediate between uranium X and the parent of radium, with the period of the order of one year. From a mathematical investigation of the effect of such a body on the growth of radium it is concluded that it would not, if it existed, appreciably alter the production of radium according to the square of the time over the period observations have been made, but it would vitiate the calculations of the period of the average life of the parent of radium according to Rutherford's formula. The same issue contains a paper by the same author on the rays and product of uranium X.—*Phil. Mag.*, December.

*Condensers.*—H. A. Wilson.—An account of experiments on the variation of the capacity of condensers with solid dielectrics with the time of charging and with the potential difference. The influence of temperature on the results is also investigated. For a definite time of charging the capacity of a condenser is nearly independent of the potential difference. The variation is not more than one part in 1000, and is probably really much less than this. Small variations appear to occur, but they are evidently due to slight temperature changes or to the after effects of the previous chargings. There is consequently no reason to suppose that anything of the nature of true hysteresis exists. The capacity is a function of the time of charging, and in the case of ebonite and sulphur, varies from 5 per cent to 20 per cent in the course of half an hour. This large variation of the specific inductive capacity of sulphur and ebonite makes these substances very unsuitable for use as insulators in experiments in which exact electrostatic measurements are to be made, unless care is taken that the total capacity is large compared with the capacity due to the insulation. The capacity $C$ at constant potential difference $V$ is given very approximately by the formula $C = C_0 [1 + B \log (1 + pt)]$, where $C_0$ is the initial value of the capacity, $t$ the time of charging, and $B$ and $p$ are constants. The constant $p$ appears to be independent of the temperature.—Lond. *Electrician*, Dec. 3.

*Hysteresis in Rotating Fields.*—W. O. Fuller and H. Grays.—It was shown by Baily that the hysteresis losses due to a rotating field in iron reached a maximum value with an induction density $B$ of about 16,000 lines per square centimeter. With a value of $B$ equal to 20,000, the hysteresis was approximately 1/20 of the value. The present authors have investigated to what extent these results were modified by variation in temperature. The results of the authors show that the effect of increasing the temperature of iron is to reduce greatly the hysteresis loss at a given induction, and to cause the maximum to occur at a lower value of $B$.—*Phil. Mag.*, December.

### Electrochemistry and Batteries.

*Solder for Aluminum.*—A note on a new solder for aluminum, which is composed of three metals, no flux is required, and a copper "bit" must on no account be used; a steel "bit" is required, or an old file will serve the purpose. Before soldering, it is necessary to scrape or file the surfaces, and so get rid of the oxide which is invariably present. The parts to be soldered are then "tinned" in the usual way with the solder, placed together with sufficient solder in between to effect a proper joint, and the hot steel "bit" is applied until the solder oozes from between the parts. When the solder has cooled it has a frosty appearance, and when polished it is difficult to distinguish where a joint has been made. The solder is also equally efficacious in making joints between aluminum and other metals, or glass or earthenware, and for filling holes in aluminum castings.—Lond. *Electrician*, Dec. 3.

### Units, Measurements and Instruments.

*Pendulum Meters.*—Aron.—Although the Aron pendulum meter has been on the market for 25 years it is still being modified to be used for new purposes. It was first built as an ampere-hour meter for a two-wire system, a magnet being suspended on the pendulum. It was then adapted to the three-wire and the five-wire direct-current systems. By substituting a shunt coil for the magnet on the pendulum the meter then was made a watt-hour meter. For a three-phase system it was built with two pendulums. In recent years the great development of metallic-filament lamps has emphasized the importance of correct readings being obtained at all loads, even at very low loads. The author gives the results of some Reichsanstalt tests which show that a 1000-watt, 110-volt meter was almost exactly as accurate with a current of 0.09 amp as with a current of 9 amp. Some recent changes in the design are described.—*Elek. Anz.*, Nov. 28.

*Reichsanstalt.*—The first part of an abstract of the official report of the Reichsanstalt for 1908. Abstracts are given of investigations of the following subjects: Temperature coefficient of volume elasticity; measurement of very small gas pressures; rate of equalization of gas pressures through capillaries; velocity of sound; specific heat of solid elements and gases; heat of evaporation of water above 100 deg. C. Approximately the formula $L = 94.210\ (365 - t)\ 0.31249$ calories, which holds for the range 30 deg. C. to 100 deg. C., is found to hold also for 100 deg. C. to 180 deg. C. A most remarkable feature is the agreement of the new values, within 0.5 per cent of Regnault's values. Investigations were also made of saturation pressure of water vapor (50 deg. C. to 100 deg. C.); Stefan-Boltzmann law; masonry pillars; spectrum analysis; fluorescence of glass and quartz; anode rays; steel measures (lengths of 10 mm, 25 mm, 50 mm and 100 mm were tested concerning constancy; some very slight changes were observed and the different behavior seems to be due to the process of tempering); tachometer tests. The article is to be continued.—Lond. *Eng'ing*, Dec. 3.

*Tachometer Tests.*—A note on tachometer tests which were carried out in 1908 in the German Reichsanstalt. They comprised a Braun liquid gyrometer for 10,000 r.p.m. and various instruments for automobiles and stationary engines. Of the latter two, one was fitted with a drum of aluminum, the other with a drum of an alloy especially designed for a very small temperature coefficient. The examination at 0 deg. C., 20 deg. C. and 40 deg. C. proved that the special alloy ($B$) was much less influenced by temperature changes than the aluminum ($A$); the $A$ instrument marking 100 r.p.m. when the actual speeds at the three temperatures mentioned were 926, 1006 and 1058 r.p.m., while the $B$ instrument actually made 953, 1000 and 1018 r.p.m.—Lond. *Eng'ng*, Dec. 3.

### Telegraphy, Telephony and Signals.

*Long-Distance Telephony.*—A note on a recent investigation of V. Karpen, who points out that the current by which the spoken word is transmitted is periodic in nature and can be split up into several harmonics differing from each other in

frequency, amplitude and phase. In fact, the speed of propagation and the constant of attenuation both increase with the frequency, with the result that during transmission the relative amplitudes and phases of the harmonics do not remain the same as at the start. The current at the receiving end is no longer of the same constitution as that produced in the microphone, and speech becomes unintelligible. It would, therefore, seem that it might be an advantage in certain cases to apply the methods used in "wireless" to ordinary telephony, to employ for transmitting purposes regularly damped oscillations of known frequency, produced by a singing arc or high-frequency alternator. The arrangements at the receiving end might be the same as those used in wireless telephony. The frequency being single, there would be no deformation of the voice, and greater distances could therefore be traversed. The difficulties of wave production would be less than in wireless telephony, for the frequency would be just sufficient for the oscillations to follow the modulations of the voice—by a variation of their amplitude. While this arrangement would do away with much of the simplicity of ordinary telephony, it would also possess many advantages.—From *Comptes Rendus,* abstracted in Lond. *Electrician,* Dec. 3.

*Experiments on Telephone Lines.*—DEVAUX-CHARBONNEL.—A note on a recent paper read before the International Society of Electricians in Paris. (A series of articles by the same author on this subject in *La Lumière Elec.* was recently noticed in the Digest.) The author examined mathematically what passes in interurban telephone lines by supposing that all phenomena are due to the transmission of a sinusoidal current having a frequency of 1000. Experience has shown him that the results obtained by this method are sufficiently close to those derived from experiment. He took into account not only the impedance of the line, but also that of the transmitting and receiving apparatus, and found that the attenuation of the current with the distance takes place in accordance with an undulating exponential curve. On account of the first undulation it comes about that at a distance varying from 3 km to 15 km the current is stronger—that is to say, the communication is better than if the transmitter and the receiver were directly connected together without any line between them. This result has been verified by experiment. The formulas indicate another curious fact. The self-induction coil, designed by Pupin to overcome the capacity of telephone or telegraph lines, improves the transmission of the current when the insulation of the circuit is perfect, but may increase the attenuation when this insulation becomes low. Calculation shows, moreover, that on long lines the impedance constants of the instruments play a more important rôle than do those of the line. The author cites the curious fact that in certain cases a subscriber, by making use of a sensitive telephone instrument, renders communication easier to the person he is calling up, but harder for himself.—Lond. *Electrician,* Dec. 3.

*Wireless Telegraphy.*—L. DUBOIS.—An illustrated description of the wireless telegraph plant at the Eiffel Tower in Paris. The construction of the antennas is shown in Fig. 5. Owing

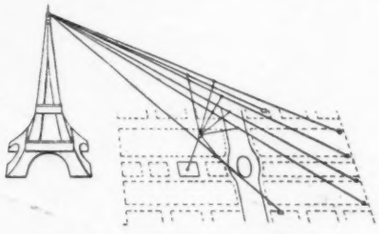


FIG. 5.—DIAGRAM OF ANTENNAS.

to the fact that the tower is situated at one end of the Champs de Mars grounds and that these latter have a length which is considerably greater than the width, the antennas had to be laid out so as to conform to these dispositions of the ground. The area of the antennas will, however, be considerable, first, owing to the height, and second, due to the great angle of spread from the base of the tower. For the antennas there will be used a set of six steel cables 5 mm in diameter, and the cables will be supported at the top of the tower each upon a separate insulating bracket, seeing that the combined weight of the six cables would give too great a stress on the insulation material should all the cables be supported on a single anchoring point For the six cables, the estimated total weight is 6.5 tons. The wave which will be produced from the high power plant will be about 2000 m long, and is of quite a different length from the wave which would be given by the metallic mass of the tower. —Lond. *Electrician,* Dec. 3.

*Wireless Telegraphy in a Certain Direction.*—R. E. NEALE.—It is difficult to explain the reason why bent antennas emit waves in a certain direction if the earth is a perfect conductor. But if the imperfect conductance of the earth is taken into account explanation is simple, as is shown by the author with the aid of diagrams.—Lond. *Elec. Review,* Dec. 3.

### Miscellaneous.

*Water Heaters.*—A note on a recent British patent (15,786, Nov. 25, 1909) of A. Ponzini for electric water heaters for use on alternating-current circuits constructed in the form of a long cylinder of iron or steel, the outer wall of which is grooved at right angles to the axis. This cylinder is surrounded by a coil which induces eddy currents in the iron. On account of the skin effect, these currents are concentrated in the annular ridges between the grooves, which act as short-circuited turns of a transformer. The heat generated is trans mitted through the wall of the cylinder to the liquid.—Lond. *Elec. Eng'ing,* Dec. 2.

*Thermo-Luminescent Glass.*—W. W. COBLENTZ.—An abstract of a recent Physical Society paper, in which the author gave an experimental demonstration of a thermo-luminescent glass made of feldspar formed into a perfect transparent rod, which was heated electrically. The luminescence appears as a faint white cloud at a temperature of about 800 deg. C., which increases in intensity with rise in temperature. The important point illustrated was that the light is white at all temperatures—that is, it does not pass through the usual chromatic changes found in the radiation from opaque substances, which would appear red at these temperatures. The absorption and behavior in a magnetic field will require further investigation.—*Physical Review,* December.

## BOOK REVIEWS.

ELEMENTE UND AKKUMULATOREN. By Dr. W. Bein. Leipzig: Johann Ambrosius Barth, 241 pages, 98 ills.

A descriptive and statistical treatise on voltaic couples, both of the primary and secondary type. The book is designed for use either as an elementary text-book in electrochemistry or as a reference book for technologists who are not specialists in the field of voltaic electricity. A large number of voltaic cells are described and tabulated, while full descriptions are given of their methods of testing and comparative behavior.

THE CALCULUS AND ITS APPLICATIONS. By Robert Gordon Blaine, M.E. New York: Van Nostrand Company. 321 pages, 79 ills. Price, $1.50.

Though we have a plethora of text-books on the calculus, yet there is room for the present one. It is written for a purpose, which it fulfills in a satisfactory manner. It is evident from the subjects treated and the mode of treatment that the author came into close contact with the struggling engineering student, whom he takes by the hand, initiates into the new order of ideas of the calculus and helps over his many difficulties by well-chosen examples, by diagrams and graphs of various kinds.

Little space is given to subjects of a purely abstract value save those of fundamental importance, by which curtailment place is found for much matter of technical interest that one does not find in accepted text-books of similar scope. Not only are the theory and use of the planimeter given, as well as an exposition of simple harmonic motion and center of pressure, but also the indicator diagram, engineering problems

on moments of inertia, and the deflection of beams under varying conditions of load.

The author has done well in including in his book chapters on the simpler and more useful parts of differential equations with practical applications to electricity and engineering. The influence of Prof. John Perry is felt throughout the book, while his somewhat extreme and revolutionary views on the teaching of mathematics are wisely avoided by the author.

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Direct and Alternating-Current Testing. By Frederick Bedell, Ph.D., assisted by Clarence A. Pierce, Ph.D. New York: D. Van Nostrand Company. 265 pages, illus. Price, $2.

A characteristic feature of this book is its complete discussion of the objects to be accomplished by each test rather than specific instructions for conducting the test. The authors have so arranged the descriptive matter that the student will be led to perform the experiments properly, but will not be driven to the mere taking of observations on instruments connected in circuit according to previously arranged plans, inserting data on blanks provided for the purpose, and substituting them later in formulas already developed. The method adopted is far preferable to the one just described in that the student obtains the maximum of mental benefit from each test, although he will be unable to report upon the maximum possible number of tests.

The manual is divided into seven chapters, dealing with direct-current generators, direct-current motors, synchronous alternators, single-phase currents, stationary transformers, polyphase currents and special transformers, respectively. In each chapter there are given first certain simple outline studies which are then followed by detailed tests. By means of this arrangement the laboratory instructor can omit more or less of the later tests, according to the limit in time to be devoted to the whole subject, without neglecting the fundamental experiments in any sub-division. A considerable portion of the work is devoted to single-phase circuits and stationary transformers, in the treatment of which very effective use is made of vectors and circle diagrams. The treatment throughout is characterized by accuracy and brevity. The book can be highly recommended as a laboratory manual for use in electrical engineering colleges.

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The Elements of the Mechanics of Materials. By C. E. Houghton, A.B., M.M.E., Associate Professor of Mechanical Engineering in New York University. New York: D. Van Nostrand Company. 186 pages, 88 illus. Price, $2.00.

This work lays special stress on the practical side of the subject without, however, slighting the mathematical theory, inasmuch as a fair acquaintance with the calculus is necessary in order to read it with anything like profit. For a student whose time is rather limited, these "Elements" will be found very useful. A commendable feature is the number of typical engineering problems that are fully worked out in the text, as well as the series of questions and the collection of numerical problems which are appended to each chapter. The work will serve as an excellent introduction to the more elaborate treatises and books of reference on the subject.

# NEW APPARATUS AND APPLIANCES

## The 110,000-Volt Circuit-Breakers of the Southern Power Company.

Four groups of 110,000-volt oil circuit-breakers were recently put in service by the Southern Power Company on its high-tension transmission lines in the vicinity of Charlotte, N. C. This installation is the first in which switching apparatus is used at such a high potential, although several similar plants are now under construction and will shortly be in operation.

In the case of the Southern Power Company's lines not only is the voltage extremely high, but the magnitude of the currents being successfully handled under these severe conditions is unusual also. In this connection it is interesting to note the rated limit of operation of these 110,000-volt circuit-breakers, namely, that they shall successfully interrupt any short-circuit that may occur on a 120,000-kw transmission system.

As shown in the accompanying illustration, a feature of the construction of these circuit-breakers is the isolation of each pole in a separate tank. Each pole is thus entirely independent of the others except for the pull-rod which operates the contacts. This rod is released by the tripping mechanism shown at the left of the tanks, thereby allowing the contacts to open by gravity. The 47-in. break thus interposed into each lead occurs in the center of the tank, in oil free from sediment or moisture. By the arrangement of the operating mechanism, gravity assists in making a quick break during normal operation, while in case of any injury to the circuit-breaker parts the circuits tend to fall open—an important safety precaution.

A double break is made at each pole, spring-seated butt contacts assuring a firm closure. A small double-pole, double-throw switch operated by the contact mechanism provides a simple tell-tale for indicating the position of the breaker contacts, by lighting a red or green lamp. The tanks are of welded-seam boiler steel, filled with oil and fitted with a thick lining of specially treated insulation which encloses the contacts. The terminals are of the condenser type, and allow the line wires to be brought in directly from overhead.

The 110,000-volt breakers for the Southern Power Company are of both the hand-operated and electrically operated types. They are normally closed by energizing the operating solenoid from a low-voltage local circuit, but may also be hand-operated by a lever handle through a simple mechanical connection. Series relays, mounted on suspension insulators and inserted

Fig. 1.—Terminals of 110,000-volt transformer.

directly in the line, are provided for automatically tripping the circuit-breakers in case of overload. A wooden rod transmits the movement of the relay armature on the suspension insulator to the latch mechanism, thus providing a simple and quick-acting mechanical release effected directly by the line current.

Fifteen breakers of type and construction similar to the

110,000-volt apparatus will also be installed by the Southern Power Company for controlling its 88,000-volt transmission circuits. These breakers will be electrically operated and have their tripping coils energized from series transformers "built in" around the terminals and mounted as part of the tank case.

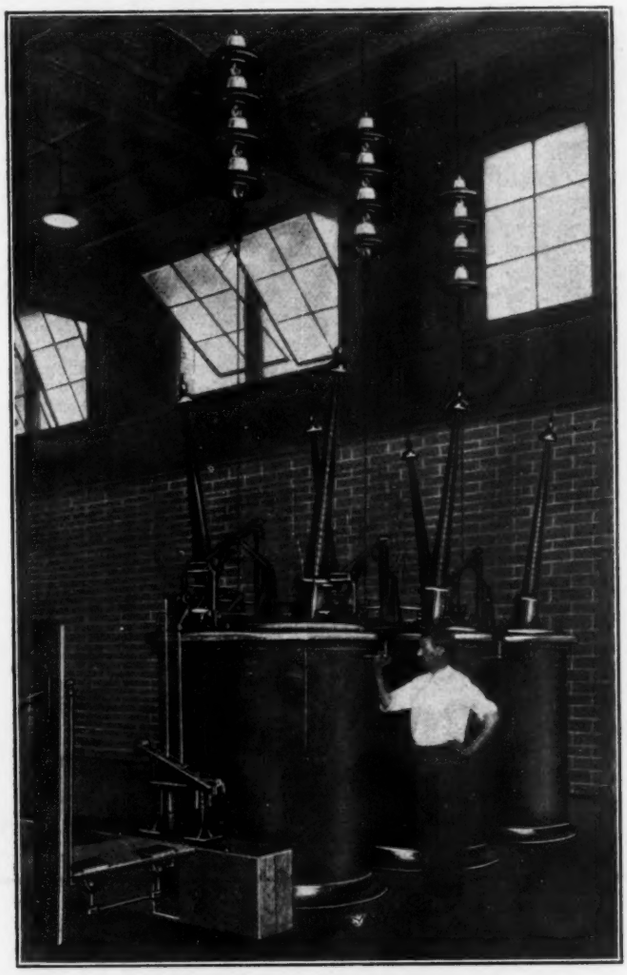


FIG. 2.—110,000-VOLT CIRCUIT-BREAKER DURING INSTALLATION.

This disposal of the series transformers contributes to the compactness and self-contained character of the breaker group, thus avoiding all external transformer or relay devices and wiring.

The 44,000-volt lines of the same company are controlled by

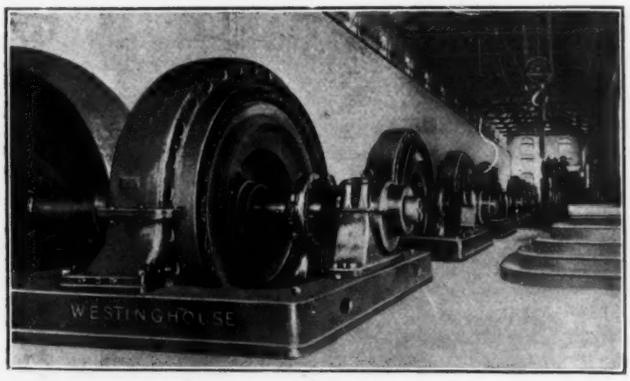



FIG. 3.—INTERIOR OF GREAT FALLS GENERATING STATION, SOUTHERN POWER COMPANY.

five sets of breakers of form similar to the high-voltage apparatus already described for operation at the lower voltage.

The 110-000-volt, 88,000-volt and 44,000-volt circuit-breakers described in the foregoing have been developed and manufactured by the Westinghouse Electric & Manufacturing Company.

## Inspection Test Set.

The Herrick inspection test set, illustrated herewith, is a self-contained instrument for rapidly and accurately determining the condition of the electrical equipment of electric cars. The set was designed by Mr. A. B. Herrick, of New York, the well-known railway engineer, who has for a number of years made many reports upon the physical condition of electric railway properties and equipments.

One of the most useful tests of which the Herrick set is capable is that of permitting a rapid and thorough inspection of the equipment of a car at periodic intervals. The test used in this case is known as the inspector's test, and is accomplished by measuring for each controller point the entire resistance of the circuits through the car. If these values correspond to a standard value, the car is passed as in good condition electrically. If the values so obtained do not correspond to standard values, the car is taken out of service for a detailed test, by means of which the trouble is localized. In one instance where the above method of inspection was used the cars were tested when they came to the end of their run. The cars were operated under a three-minute headway, and were tested during one day without interfering with the schedule.

The set is arranged for seven tests, and connections for each

INSPECTION TEST SET.

test are made in the instrument by simply inserting a plug. An interlocking arrangement prevents the damaging of the instrument due to improper connections. The first test is known as the inspector's test, described above. The second test is the detail test, whereby the resistance of any portion of the equipment may be determined separately. By means of this test trouble showing in the inspector's test may be localized.

In addition to the above tests, the set may be arranged to measure resistance through a range of 1.5 ohms or 150 ohms, thus allowing for high or low resistance measurements. A setting is provided for the detection of grounds, and also one for the measurement of insulated resistance. The final test, known as the inductive balance test, detects a motor armature which is out of center, and also detects reversed fields.

The inspection set is portable, and can be carried from place to place in the car barn (or wherever else it may be employed) by two men. Convenient handles for this purpose are provided on the sides of the case. The testing current is 2 amp, the current being taken from the trolley circuit through lamp banks. The testing set is made by the Leeds & Northrup Company, Philadelphia.

# Industrial and Commercial News

## Commercial Intelligence.

THE WEEK IN TRADE.

Retail and holiday trade throughout the country was considerably stimulated last week by the seasonable weather. It is reported in many portions of the North and West that the returns are better than for any previous year. This is especially true in Chicago, Kansas City and Portland, Ore. In fact, the reports from the cities of considerable size are better than from the country towns. Reports from wholesalers and jobbers are very satisfactory. The majority of the orders, of course, that are being received at the present time are to fill in broken stocks, but these are coming in sufficient volume to make a very good trade. The switchmen's strike in the Northwest has done something to delay freights, and thereby impede the free movement both of the crops and of merchandise. It has, however, added very largely to the earnings of the express companies. Industrial operations are still extremely active. Mills are busy on old orders, and new orders are piling up for next year's delivery. Very heavy specifications are being received for structural materials, contracts for which were placed at lower prices early in the year. Railways have been good buyers of cars and other equipment. The prices of commodities continue to be at top figures, adding to the cost of living and threatening discontent among wage earners. Collections have fallen off perceptibly, as is generally the case just preceding the holidays. Business failures for the week ended Dec. 16, as reported by *Bradstreet's*, were 273, against 259 the week previous, 311 in 1908, 300 in 1907, 227 in 1906 and 235 in 1905.

EMPIRE DISTRICT ELECTRIC COMPANY BONDS.—Sales of the bonds of the Empire District Electric Company are being made in Wall Street, Williams, McConnell & Coleman, 60 Wall Street, being the distributing agents of these securities. It is stated that the original issue of these bonds was over-subscribed, and that since they have been issued they have been selling at a premium. H. L. Doherty, who is president of the company, will be in active management. The company will serve a population of more than 70,000, and will cover the lead and zinc mining districts of southern Missouri.

THE COPPER MARKET.

The copper market during the past week has not been active, nor has it been significant of any movement in either direction. Just at the present time the market seems to be unusually susceptible to speculative influences, and there are almost daily fluctuations, fractional for the most part, in electrolytic as well as standard copper. The takings by consumers, both here and abroad, have not been large, but reports from the manufacturers indicate that the actual consumption of copper is steadily increasing. It has been well known for a long time that the majority of consumers were very well stocked, and as at the present moment the prices of copper are not particularly attractive, it can hardly be considered surprising that there is a tendency to delay additional purchases until after the first of the year, in order that they may appear in the 1910 business. Statistically there is little change in the position of the metal market. Production continues at the top notch, and there is every reason to expect a considerable addition to the accumulations of copper in the December report. On the other hand, traders are continually encouraged by the prospect of a great merger or combination of interests that will control output if not prices. The practical success of the Guggenheim merger plans is taken to mean the eventual success of the larger plans which have been discussed for the past two months. Since the adverse decision in the Standard Oil case there has been some uneasiness lest such a merger as the Cole-Ryan interests proposed would prove illegal. It is now reported that sanction for this consolidation has been received from the very highest Federal authority. Exports have hardly been as active as during November. From the present prospects there will be about 24,000 tons shipped abroad during the current month. Exports so far reported for the month up to and including Dec. 20 amount to 17,951 tons. The daily call on the Metal Exchange, Dec. 20, quotes standard copper:

| | Bid. | Asked. | Settling price. |
|---|---|---|---|
| Spot | 12.87½ | 13.12½ | —— |
| December | 12.87½ | 13.15 | 13.05 |
| January | 12.95 | 13.25 | 13.05 |
| February | 13.00 | 13.37½ | 13.15 |
| March | 13.05 | 13.40 | 13.22½ |
| April | 13.10 | 13.50 | 13.30 |

The London prices Dec. 20 were as follows:

| | Noon. £ | s | d | Close. £ | s | d |
|---|---|---|---|---|---|---|
| Standard copper, spot | 60 | 0 | 0 | 60 | 2 | 6 |
| Standard copper, futures | 61 | 2 | 6 | 61 | 5 | 0 |
| Market | Firm | | | Firm | | |
| Sales of spot | 500 tons | | | | | |
| Sales of futures | 350 tons | | | | | |

Extreme fluctuations for this year:

| | Highest. £ | s | d | Lowest. £ | s | d |
|---|---|---|---|---|---|---|
| London, spot | 64 | 2 | 6 | 54 | 12 | 6 |
| London, futures | 64 | 17 | 6 | 55 | 10 | 0 |
| Standard | 13 | 45 | 0 | 12 | 12½ | 0 |
| London, best selected | 67 | 15 | 0 | 59 | 0 | 0 |

GENERAL ELECTRIC TAKES OVER PART OF WESTERN ELECTRIC MANUFACTURING BUSINESS.—The long rumored deal between the General Electric Company and the Western Electric Company, whereby the latter will retire from the manufacture of heavy electrical apparatus, has been consummated. The deal involves the transfer to the General Electric Company of the patents and tools used by the Western Electric in the manufacture of light and power apparatus, with an arrangement under which the latter company will continue to sell heavy apparatus manufactured by the General Electric. The plant of the Western Electric Company will be devoted exclusively to the manufacture of telephonic apparatus and smaller electrical appliances. From an authoritative source in the Western Electric office, confirmation of this deal was obtained. It was said that the continued growth in the demand for telephone apparatus indicated even a more expanded demand in the future and that the Western Electric officials concluded that it would be wiser for the company to specialize on smaller electrical appliances, just as the General Electric and the Westinghouse Electric & Manufacturing have specialized on larger appliances. At the General Electric Company's office it was said that much of the heavy apparatus of the Western Electric Company had been made, for many years, by the General Electric Company and that the present deal was only an expansion of the existing relations.

SHAWINIGAN WATER & POWER COMPANY.—The Shawinigan Water & Power Company, of Montreal, has decided to carry out a most aggressive policy of expansion and development. The rapid growth of business all over the Province of Quebec has caused the directors to make this decision. On Dec. 16 the management announced that it had put into service the extra 10,000 hp, which gives the company a capacity of no less than 54,000 electrical hp in the generating station at Shawinigan Falls, besides which there is 35,000 hp sold as hydraulic horse-power direct from the head works. During the week contracts were placed for apparatus to increase one of the present 500-hp units to a capacity of 10,000 hp. The demand for power is in excess of the company's ability to install machinery to meet it. The financial position of the company is particularly strong at present, the gross earnings for November showing over $64,620. In regard to the rumored increase in capital, the treasurer, Howard Murray, stated that none would be made at present as the $500,000 recently issued would meet requirements for some time. Mr. Murray declined to say anything about a probable increase in dividends.

ROANOKE (VA.) ELECTRIC LIGHT & POWER COMPANY.—A large tract of land and water rights along the Staunton River, Virginia, in the vicinity of Brookneal, have been secured by the Roanoke Electric Light & Power Company, and it is proposed to erect a large hydroelectric plant at this point. It is estimated that 5000 hp can be developed, which will be transmitted to Lynchburg and other cities in the vicinity. The company is capitalized at $1,000,000.

MOTOR DRIVES FOR AUTOMOBILE SHOPS.—Among electric-motor equipments recently furnished by the Allis-Chalmers Company to the automobile manufacturers in the neighborhood of Detroit, Mich., are the following: The Everett-Motzger-Flanders Company, Detroit, three 300-kw generators and exciters, four 100-kw, oil-filled, water-cooled transformers and 64 induction motors. This company uses a 30-hp, 850-r.p.m. motor as standard and thus has to carry but few repair parts. To the Oak Park Power Company, of Flint, Mich., two 1000-kw steam turbine units with direct-coupled exciters, one non-condensing, the other condensing, with turbo jet condenser and motor-generator exciter set; two 200-kw alternators with exciters, 21 transformers and a large number of motors. To the Weston-Mott Company, of Flint, Mich., a large number of induction motors of 40 hp, 850 r.p.m., as standard. To the Kelsey-Herbert Wheel Company, of Detroit, transformers and six induction motors. To the Rapid Motor Vehicle Company, Pontiac, Mich., two engines direct-connected to 600-kw, 60-cycle, 3-phase, 240-volt generators, and a 45-kw induction motor-generator exciter and a 40-kw engine exciter set. To the American Motor Castings Company a 100-kw engine generator set and six induction motors. To the Brush Runabout Company, Detroit, Mich., three 100-kw transformers and 20 induction motors. This company has adopted 20 hp and 850 r.p.m. as its standard.

GENERAL ELECTRIC COMPANY.—An official of the General Electric Company is responsible for the statement that the company expects to close the year with orders received which will amount well up toward the best previous year. It is true, however, that the business is in smaller material relatively than it has been in some former years. During the past season there has been an extensive demand for small apparatus, and this has kept the shops very busy. All over the country there has been a large Christmas trade in electrical household appliances. This business has been the largest ever known. The demand for electric meters from the lighting companies throughout the United States has been the largest ever known, and this in itself is an indication that there is a vast increase in the number of consumers.

ELECTRICAL CONSTRUCTION.—Among the items printed under Construction Notes in our present issue are announcements of proposed new plants or considerable extensions of present plants at Portland, Maine; Statesboro, Ga.; Chesaning, Mich.; Hamilton, Mont.; Berkley Springs, W. Va.; Santa Barbara, Cal.; Portland, Ore.; Grand Forks, N. D.; Boone, Ia.; Canal Dover, Ohio; Gainesville, Tex.; Apex, N. C.; Yacolt, Wash.; Plaquemine, La.; Erie, Kan.; McKinney, Tex.; Kooskia, Idaho; Massillon, Ohio; Cleveland, Ohio; Greenville, Ga.; Paragould, Ark.; Little Rock, Ark.; Millville, W. Va.; St. Paul, Minn.; Fort Wayne, Ind.; Boulder, Col.; Waycross, Ga.; Lynchburg, Va.; Lyons, N. Y.; Ralston, Okla.; Anoka, Minn.; Niles, Ohio, and Mount Vernon, Ohio.

FEDERAL CORPORATION TAX.—It is reported in Washington that there is a violent difference of opinion between the Treasury Department and the Department of Justice about the terms "net income and cash profits" in the new Federal corporation tax law. It is stated that Attorney-General Wickersham is very much affronted because the Treasury Department has issued regulations without consulting him. It is intimated, also, that the regulations issued may be recalled. The attorneys who are fighting the corporation tax in the Federal courts expect to win their cases, but the Treasury Department is still confident that the law will hold good.

JAPAN BUYS MORE AMERICAN TELEPHONE APPARATUS.—Another telephone switchboard order from the Far East has been placed with the Western Electric Company. The Japanese Department of Communications is the purchaser, the equipment being used to extend the service in the capital city of Tokyo. This board is standard equipment of the sort used by the Bell companies in this country and in general use abroad. It is a common battery switchboard of up-to-date type. The same company recently contracted to supply the Chinese Government the equipment for the first two modern telephone exchanges in that Empire, to be located in Pekin.

ELKHART (IND.) GAS POWER COMPANY.—A company is being formed under the name of the Elkhart (Ind.) Gas Power Company to compete with the Indiana & Michigan Electric Company. The citizens of Elkhart are back of the project. The formation of this new company, it is said, is the result of a recent increase in rates by the older corporation, which goes into effect Jan. 1. The stock of the new concern is subscribed for by a number of leading manufacturers, and it is proposed to equip a plant to supply electricity for power exclusively. The plant will be equipped with gasoline engines.

GUATEMALA GOVERNMENTAL SUPERVISION OF ELECTRICAL SUPPLIES.—As the outcome of the special legislation giving the Guatemalan Government direct supervision of all electrical enterprises, a Presidential decree of Oct. 21, 1909, allows the importation of electrical supplies only on written permission granted by the War Department upon application. The decree also requires such enterprises now existing to furnish to the competent authority the description and destination of all orders for material placed before the promulgation of the present law.

RUSH WORK ON ELECTRIC ENGINES.—Orders have been received at the East Pittsburgh shops of the Westinghouse Electric & Manufacturing Company to rush the work as rapidly as possible on the large electric locomotives of the Pennsylvania Railroad. These are the engines that are to be used in the New York terminal, and the company is almost ready to put them into service. Two of these engines have been delivered, and have been thoroughly tested on the Long Island Railroad tracks. It is said that they have proved entirely satisfactory.

NORFOLK & WESTERN RAILROAD USING TELEPHONES.—The Norfolk & Western has recently placed an order for four complete train despatching circuits with the Western Electric Company. These circuits will operate from Norfolk to Crewe, 130 miles, 27 stations; Crewe to Roanoke, 126 miles, 3 stations; Williamson, West Va., to Portsmouth, O., 113 miles, 22 stations, and Portsmouth to Columbus, O., 100 miles, 22 stations. These circuits are in addition to the two already in operation, which have been heretofore referred to.

HAMILTON, MONT., HYDROELECTRIC DEVELOPMENT.—The municipal plant of Hamilton, Mont., is preparing to construct a hydroelectric plant on Sleeping Child Creek, six miles from that city. The plans and specifications have been completed and contracts will soon be let. The cost of the construction will be about $150,000, and it is calculated that from 1500 to 2000 hp will be developed.

TULOROSA COPPER COMPANY.—F. P. Kern, president of the Tulorosa Copper Company, was in New York last week making contracts for electrical equipment to furnish power and light in the company's plant in New Mexico. The company's mill will have an initial capacity of 100 tons of ore a day. Recent prospecting upon the property gives promise of large values.

PIEDMONT ELECTRIC COMPANY.—The business of the Piedmont Electric Company, which was organized at Anderson, S. C., in 1904, is being closed out, and the company will retire from business. It is stated that the lack of capital is responsible for this step. The present stockholders were unwilling to invest more in the venture.

## *Financial Intelligence.*

THE WEEK IN WALL STREET.

The market in Wall Street during the past week has been irregular and, as far as trading is concerned, rather dull. The tone, however, has been fairly strong, and as a general thing there have been fractional advances in quotations. There have been very few developments during the week of sufficient importance to cause any pronounced fluctuations. The advance in the dividend rates of Louisville & Nashville and of Reading, of course, had a strengthening effect upon the market, but these advances had long been expected, and it might be said were long over due. On Dec. 20 there was a sharp advance in Consolidated Gas, due to reports that a melon of some character was about to be cut. One story was that a real estate company was being formed to take over unused property belonging to the Consolidated Gas Company, and that the stock of this company would be distributed among the shareholders of the gas company. Another story was that the dividend rate would be increased from 4 to 6 per cent on account of the excellent earnings during the past year. This seems to be the more reasonable story. In many respects the market has been manipulated during the past week or 10 days, and this is due to the fact that a large number of professional traders always expect an advance about the end of the year or

just after New Year. It is assumed that investors at this time will probably have money with which to buy, and that after having collected their dividends on securities which they now hold they will invest a portion of the money in new securities. For this reason it is not unusual for regular traders to load up with stocks about the middle of December in order to dispose of them when the outside buying begins. The physical condition of business is such that it would be almost impossible for the tone of the market to be otherwise than strong. The industrial world is prospering as never before, and even the threatened "declaration of war" made by the labor unions against the United States Steel Corporation has been ignored. In view of the present tremendous demand for steel products, there are not many people afraid that labor complications will seriously interfere with earnings. Returns from the railways show largely increased gross earnings. While the switchmen's strike in the Northwest has hampered traffic there, elsewhere shipments are heavy and rates are expanding. The monthly returns for November show an increase over the previous year of about 13.2 per cent. The money market continues to be in a fairly satisfactory condition, although in both London and Berlin there is a tightening tendency which is causing some restriction of loans. It is the general opinion, however, that this is temporary, and that after the first of the year the market will ease up. Locally there seems to be plenty of money to supply every demand, and rates have not been advanced sufficiently to cause any trouble. Quotations Dec. 20 were: call, 4½ @ 5 per cent; 90 days, 4½ per cent. The quotations in the table are those of the close, Dec. 20.

NEW YORK.

| | Dec. 14. | Dec. 20. | Shares sold. | | Dec. 14. | Dec. 20. | Shares sold. |
|---|---|---|---|---|---|---|---|
| All.-Ch. ..... | 15½ | 15⅛ | 900 | Int.-Met.,pfd.. | 61⅝ | 61 | 39,650 |
| All.-Ch., pfd.. | 53¾* | 55 | 3,800 | Mackay Cos.. | 91½ | 90½ | 200 |
| Amal. Cop.... | 88⅛ | 87⅞ | 88,900 | MackayC.,pfd. | 76¼ | 77½* | 500 |
| Am. D. T.... | 20½* | 20½* | ——— | Man. Elev.... | 140½* | 139½ | 225 |
| Am. Loc..... | 61¾ | 60¾ | 1,700 | Met. St. Ry.. | 23* | 23* | ——— |
| Am. Loc., pfd. | 114 | 114* | 757 | N.Y.&N.J.Tel. | 139¼* | 139¼* | ——— |
| Am. Tel. & C. | 80 | 77½* | 43 | Steel, com.... | 91⅞ | 91⅞ | 627,607 |
| Am. T. & T.. | 143 | 142½ | 11,900 | Steel, pfd.... | 125½ | 125 | 10,335 |
| B. R. T..... | 80¼ | 80½ | 16,390 | W. U. T..... | 78½ | 77½ | 4,712 |
| Gen. Elec.... | 160½ | 160 | 2,850 | West'h., com. | 84 | 81¾ | 8,500 |
| Int.-Met.,com. | 24⅝ | 24¼ | 39,100 | West'h., pfd.. | 135* | 133* | 500 |

PHILADELPHIA.

| | Dec. 14. | Dec. 20. | | Dec. 14. | Dec. 20. |
|---|---|---|---|---|---|
| Am. Rys..... | 47 | 47 | Phila. Elec..... | 13½ | 13⅞ |
| Elec. Co. of A..... | 12⅜* | 12⅜* | Phila. R. T..... | 28⅛ | 27¾ |
| Elec. St. B'ty..... | 57¼ | 58¼ | Phila. Trac..... | 88¾ | 88½* |
| E. S. B'ty, pfd..... | 30* | 30* | Union Trac..... | 52½ | 52½ |

CHICAGO.

| | Dec. 14. | Dec. 20. | | Dec. 14. | Dec. 20. |
|---|---|---|---|---|---|
| Chi. City Ry..... | 180* | 180* | Chi. Tel. Co..... | 136 | 136* |
| Chi. Rs., Ser. 1..... | 100 | 105 | Met. El., com..... | 18 | 19¼* |
| Chi. Rs., Ser. 2..... | 30 | 33 | Met. El., pfd..... | 56 | 58 |
| Com. Edison..... | 118 | 118½ | Nat'l Carbon..... | 105 | 103¾ |
| Chi. Subways..... | 5⅛* | 4⅞* | Nat'l Car., pfd..... | 123* | 123* |

BOSTON.

| | Dec. 14. | Dec. 20. | | Dec. 14. | Dec. 20. |
|---|---|---|---|---|---|
| Am. T. & T..... | 141⅛ | 142⅝ | Mex. Tel..... | 2½ | 2½* |
| Cum. Tel..... | 145⅞* | 145⅜* | Mex. Tel., pfd..... | 5½ | 5½* |
| Edison E. Ill..... | 250 | 250 | N. E. Tel..... | 136¼ | 137 |
| Gen. Elec..... | 160⅞* | 160 | W. T. & T..... | 12 | 15 |
| Mass. E. Ry..... | 15⅞ | 15½ | W. T. & T., pfd.... | 89½ | 96 |
| Mass. E. R., pfd.... | 77½ | 79 | | | |

* Last price quoted.
Shares sold are for week of Dec. 13 to Dec. 18.

POSTAL TELEGRAPH CABLE COMPANY.—Charles P. Bruch, vice-president of the Postal Telegraph Cable Company, of New York, has confirmed the report of the forthcoming reorganization of at least two of the large telegraph systems, insofar as changes of name may be regarded as reorganization. The corporate title of the Postal Telegraph Cable Company is to be changed to the Transcontinental Cable Company, and that of the New England Telegraph Company to be changed to the Postal Telegraph Cable Company. There are now 16 companies operating in various States under the title of Postal Telegraph Cable Company, and six others operating as Postal Telegraph & Cable Company in various other States, and there are still others known as Postal Telegraph companies. These, with 79 other operating companies in various parts af the country, are owned or controlled by the Mackay Companies, a voluntary association. The present change is in name only, and does not involve any new financing or any change in method of operation.

QUEBEC RAILWAY, LIGHT & POWER COMPANY.—A final statement has been issued in connection with the consolidation of public utilities in the city of Quebec. It states that the merger has been entirely completed, and that the Quebec Railway, Light & Power Company will take over the Quebec-Jacques Cartier Electric Company, the Canada Electric Light Company, the Quebec Gas Company and the Frontenac Gas Company. As heretofore stated in these columns, the new company will have an authorized capital stock of $10,000,000 and an authorized bond issue of $10,000,000. It is expected that $9,500,000 of the stock will be issued, and $8,654,000 of the bonds. These issues will not only provide for full payment for the companies taken over, but will give the new company ample working capital.

NEW YORK & HARLEM RAILROAD COMPANY.—The directors of the New York & Harlem Railroad Company, which owns the Madison Avenue line in New York City, have filed a petition in the United States Circuit Court asking that the court direct the Metropolitan Street Railway Company receivers either to surrender the property or to assume the unpaid franchise taxes and all the obligations of the lease of 1896. It was under this lease that the Metropolitan Street Railway acquired control of the line. If the property is surrendered by the receivers, which seems more probable than that the back assessments will be paid, it would mean that all transfers between these lines and the Metropolitan system would be cut off.

SHORE LINE ELECTRIC RAILROAD COMPANY.—The Shore Line Electric Railroad Company, of New Rochelle, N. Y., was incorporated at Albany last week with a capital stock of $300,000. This company is a reorganization of the Tarrytown, White Plains & Mamaroneck Company, whose property was sold some time ago under foreclosure to F. L. Babcock for $450,000. Among the incorporators are F. L. Babcock, Edward A. Maher, president of the Bronx Traction Company; Reune Martin, secretary of the Union Railway Company; Dudley Olcott and E. Francis Hyde, president of the Central Trust Company.

INTERSTATE RAILWAYS COMPANY.—Arrangements have been made by the Earle readjustment committee of the Interstate Railways Company, of Philadelphia, to pay the charges and expenses of the Philadelphia Trust Company for acting as depositor of Interstate bonds under the plan of the former reorganization committee, which has since been dissolved. After these expenses have been paid a demand will be made upon the Philadelphia Trust Company by the bondholders for the release and delivery of their deposited bonds. This will put the company in a position to be reorganized by the bondholders.

LONG ISLAND ELECTRIC RAILWAY COMPANY.—During the fiscal year which ended June 30, 1909, the Long Island Electric Railway Company, running to Rockaway Beach and owned in part by the Long Island Railroad Company and the Interborough Rapid Transit Company, received $165,375 in five-cent fares. The other revenues of the company brought the total gross receipts to $185,368. The expenses for operation totaled $144,075, leaving a net revenue of $41,292. After paying taxes and corporate charges the surplus carried over for the year was $2,187.

MASSACHUSETTS ELECTRIC COMPANIES.—At the annual stockholders' meeting of the Massachusetts Electric Companies last week the old trustees were re-elected, and the stockholders authorized them to sell the preferred stock of the Boston & Northern and of the Old Colony Street Railway companies. They were also authorized to issue notes not to exceed $5,000,000, the proceeds to be used to refund the $3,500,000 4½ per cent notes coming due next July.

WESTBOROUGH (MASS.) GAS & ELECTRIC COMPANY.—The Gas Commissioners of Massachusetts have approved an issue of 115 shares of new capital stock of the Westborough Gas & Electric Company. The par value of this stock is $100. The proceeds are to be used for making improvements on the property and extending the transmission lines and mains of the company into new territory.

VIRGINIA RAILWAY & POWER COMPANY.—Securities of the Virginia Railway & Power Company, of Richmond, will probably be listed in a short time on the Philadelphia Stock Exchange. The common stock of this company during the past week has been selling for between 19 and 20, while the preferred has been selling for about 68. The 5 per cent bonds have recently sold at 90.

MAHONING & SHENANGO BONDS.—Lee, Higginson & Company and Blair & Company are offering the unsold balance of $3,800,000 first consolidated refunding mortgage 5 per cent bonds of the Mahoning & Shenango Railway & Light Company. The offer is made at 97 and interest. A considerable amount of the issue has already been placed with foreign investors.

J. P. MORGAN IN TELEPHONE DEAL.—Announcement was made last week that J. P. Morgan & Company are the purchasers of the United States Telephone Company and the Cuyahoga Telephone Company, of Cleveland; also the majority of the stocks of the Toledo Home Telephone Company, the Citizens' Telephone Company, of Columbus, O., the Dayton Home Telephone Company, the Indianapolis Telephone Company, the New Long Distance Telephone Company of Indiana and the New Telephone Company of Indianapolis. The United States Company was the long-distance operating company throughout northern Ohio and southern Michigan. James S. Brailey, Jr., who recently acquired the United States Company and the Cuyahoga Company, and large interests in the other companies, declares that these purchases were made by Mr. Morgan for his personal account, and that the properties will continue to be operated Independent. The fact that Mr. Morgan is known to have been interested with the American Telephone & Telegraph Company in the acquirement of practical control of the Western Union Telegraph Company leads to the assumption that the present deal is a transfer of Independent interests to Bell interests. In our last issue we told of the transfer of about 19,000 shares of the stock of Independent companies to R. L. Day & Company. This transfer was made, so it was stated, at the suggestion of officials of the American Telephone & Telegraph Company. It now appears that it was in reality the Morgan firm which bought the stock. Theodore N. Vail, president of the American Telephone & Telegraph Company, and Henry P. Davidson, of J. P. Morgan & Company, have made statements denying that there has been any absorption of the Independent companies by the Bell interests. These gentlemen declare that the purchase of the stocks of the Independent companies had no connection in any way with the American Telephone & Telegraph Company. The amount involved in these purchases is about $10,000,000. The system which Morgan & Company have acquired embraces 101,500 telephones and 40,000 miles of long distance lines, covering Ohio, Indiana and Michigan.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY.—It is given out by officials of the Westinghouse Electric & Manufacturing Company that the first six months of its fiscal year will show earnings more than sufficient to pay the regular dividends and all of the back dividends on the preferred stock. It is not expected, however, that all of the back dividends will be paid at one time. Robert Mather, chairman of the board, is determined that the policy of gradual payments shall be followed out. Previous to the first payment the default of back dividends amounted to $490,000. Three months ago the first payment was made, of about $140,000. The December payment will amount to about the same amount, leaving only about $210,000 to be paid. This could be easily covered at one dividend period, but it is the policy of the company to add to its accumulations. It is stated that the net profits of the concern are now running at the rate of $300,000 a month. The asset value of the assenting stock is now computed by insiders to be about 120. In the month of November the shipments made by the Westinghouse Electric & Manufacturing Company from Pittsburgh and Newark aggregated about $2,500,000, and with other shipments made by subsidiary companies the total business was about $3,000,000. This is the largest month that the company has had for many years. It is now estimated that the total business for the year of the Westinghouse company will amount to between $30,000,000 and $35,000,000.

TOLEDO RAILWAYS & LIGHT COMPANY.—Practically all of the $4,866,000 outstanding of the 4 per cent bonds of the Toledo Railways & Light Company which fell due July 1, 1909, and on which the company is in default, have been deposited with the bondholders committee, and 75 per cent of the capital stock is also in the hands of protective committees. There has been no plan yet announced for the readustment of the financial conditions of the company. Until the new city council meets in January the question of extending the company's franchise will not be considered. Practically all of the franchises now held by the company will expire before 1915, and the main difficulty in refinancing the company has been the uncertainty as to the renewal of franchises. It is now believed that the city administration will be liberal, and that franchises will be granted on terms which will permit the operation of a dividend paying company.

SOUTHERN CALIFORNIA EDISON COMPANY.—The general mortgage 5 per cent gold bonds of the Southern California Edison Company, which is the successor to the Edison Electric Company, of Los Angeles, are being offered by N. W. Harris & Company, of New York and Boston; E. H. Rollins & Sons, Boston, Chicago, Denver and San Francisco, and the Harris Trust & Savings Bank, Chicago. These bonds are being offered to the public at 97½ and interest, and at that figure will yield about 5.17 per cent. The company has generating plants, water and steam, approximating 60,000 hp. It serves Los Angeles, Pasadena, Riverside, Redlands and a number of other cities, having a total population of over 600,000.

VALUE OF BROOKLYN RAPID TRANSIT.—Bion J. Arnold, consulting engineer of the Public Service Commission, testified at a hearing last week that he estimated the physical value of the property of the Brooklyn Rapid Transit Company at $100,000,000. This estimate was based upon the cost of reproduction, and made no allowances for the organization costs or for discounts which had to be accepted upon the sale of securities. Mr. Arnold stated that if all these matters were considered the value of the property would probably be equal to its total capitalization, which is about $141,000,000.

CHICAGO-MILWAUKEE ELECTRIC COMPANY.—It is stated that the bondholders of the Chicago-Milwaukee Electric Company will take the road over from the receiver in January and will operate it under a new management. It is stated that the net earnings of the last fiscal year were about $159,000, or 1 per cent on the outstanding bonds. The $10,000,000 bonds of the Wisconsin division are held largely in Canada. The $5,000,000 of the Illinois division were held originally in the Netherlands, but many of these have recently been secured by Canadian and American interests.

SUPERIOR WATER, LIGHT & POWER COMPANY.—Redmond & Company, 33 Pine Street, New York, are offering to the public $100,000 of the 4 per cent sinking fund bonds of the Superior (Wis.) Water, Light & Power Company. The price at which these bonds are offered is 81 and interest, netting 5½ per cent to the investor. It is stated that the earnings of the company during the past six years have about doubled. There are outstanding only $1,500,000 of bonds, and the net earnings for the past year were more than double the interest charge.

CALIFORNIA BOND CASE DECIDED.—In the case of the Merced River Electric Company, of California, the Supreme Court of that State has recently decided that a corporation cannot be prevented from issuing bonds because its actually subscribed stock is less than the amount of bonds sought to be issued. The company proposed to issue $1,500,000 of bonds while the actual subscriptions to its stock were only $2,500. The Secretary of State refused permission, and the present decision grants a compelling mandamus.

HUDSON & MANHATTAN RAILROAD COMPANY.—William G. McAdoo, president of the Hudson & Manhattan Railroad Company, has applied to the New Jersey Board of Assessors for the reduction of the tax assessment on the properties of his company in Jersey City and Hoboken. He states that so far the tunnels have not been a paying investment. He expressed the opinion, however, that when the system is entirely completed in Jersey City the return will be sufficient to pay a dividend upon investment.

BLUE LAKES (CAL.) WATER COMPANY BONDS.—The County Recorder of Jackson, Cal., has just recorded for the Mercantile Trust Company, of San Francisco, an acceptance of the trusteeship of the $5,000,000 bonds of the old Blue Lakes Water Company. This concern was one of the properties that eventually came into the control of the Pacific Gas & Electric Company.

HICKORY (N. C.) WATER-POWER DEVELOPMENT.—Col. M. E. Thornton, president of the Thornton Light & Power Company and of the Hickory Water-Power Electric Company, is offering a bond issue of $850,000, the proceeds to be expended in developing a 9000-hp water-power property owned by the last-mentioned company.

OKLAHOMA GAS & ELECTRIC COMPANY—William P. Bonbright & Company, New York, are offering $150,000, 7 per cent cumulative preferred stock of the Oklahoma Gas & Electric Company, Oklahoma City, at 98. This price nets the investor 7.14 per cent.

CONSOLIDATION OF WESTCHESTER ELECTRIC LINES.—The application made by the New York, New Haven & Hartford Railroad Company to the Public Service Commission of the Second District for permission to consolidate the New York, Westchester & Boston Railway with the New York & Portchester Railroad has been granted. The Board of Estimate and Apportionment of the City of New York has also given its permission to this consolidation. The new company will be called the New York, Westchester & Boston Railway. It is a joint agreement between the two traction companies to consolidate their capital stock, property and franchises, and it is provided that the stock of the new company is not to exceed $5,000,000. The new corporation is authorized to abandon those portions of the roads of the two consolidated companies which are not necessary to form one continuous line from the Harlem River to Portchester, with a branch from 177th Street to Throgg's Neck, and another branch from Mt. Vernon to White Plains. The commission refused to permit the abandonment of the line from Classon's Point to Throgg's Neck. It is planned to have a four-track line from 138th Street to Portchester. The original capitalization of the two companies was a total of $20,000,000 in stock and $35,000,000 in bonds.

GUGGENHEIM COPPER MERGER.—The proposed plan of merging the Nevada Consolidated Copper Company and the Boston Consolidated Copper Company into the Utah Copper Company, which was outlined in our last issue, is progressing in spite of the fact that a number of the minority stockholders of the Nevada Company are vigorously protesting. These stockholders declare that their property is more valuable than the Utah Company, and that the ratio of exchange, by which 2½ shares of the Nevada Company's stock are to be traded for 1 share of the Utah Copper Company's stock, is unfair and that they will resist any consolidation on such a basis. In the meantime steps have been taken to increase the capital stock of the Utah Copper Company from 750,000 shares to 2,500,000 shares, in order that it may be prepared to take over the other properties. It is said in copper circles that the present consolidation is but a forerunner of the big consolidation of copper interests that is being engineered by the Cole-Ryan party and the Amalgamated Copper Company.

NORTH AMERICAN COMPANY.—James Campbell, the newly elected president of the North American Company, said in St. Louis the other day that, so far as he was concerned, the administration of the company would be carried on in that city. He also denied that there was any truth in the report that the company was to become a holding organization for Standard Oil properties, or for 'Frisco and Rock Island Railroad properties. It is given out that the company does not contemplate the declaration of an extra dividend as a result of the recent sale of the Laclede Gas Company. Approximately $7,500,000 was realized in this transaction, but only about $3,500,000 has been paid, and the remainder is not due for some time. The officials think that this money should be placed in reserve, as it cannot properly be called profits. The earnings of the company are expected to exceed last year, and the outlook is considered very promising.

WESTINGHOUSE AIR BRAKE COMPANY.—The earnings of the Westinghouse Air Brake Company for the past year have been extremely large. At the quarterly meeting of its Board of Directors last week it declared the regular quarterly dividend of 2½ per cent, an extra dividend of 1½ per cent and a special dividend of 1 per cent. This means a disbursement of $700,000 upon its capital stock of $14,000,000. It is said that December bids fair to be larger than November, which was the third largest month in the history of the company. The plant is running night and day.

UNITED STATES GAS & ELECTRIC COMPANY.—The Wayne County Electric Company, of Lyons, N. Y., which was recently purchased by William T. Morris, has been taken over by the United States Gas & Electric Company. The company will be operated under its own name as a separate organization from the holding company. In the spring it is proposed to remove the plant and increase its efficiency.

HILL BUYS INLAND EMPIRE.—James J. Hill, chairman of the board of directors of the Great Northern Railroad Company, has announced that the railroad company has purchased a controlling interest in the Spokane & Inland Empire Railway System, of Spokane, Wash. He says that the road will be used as a feeder to the Great Northern system.

PORTLAND (ORE.) GAS COMPANY SOLD.—The Eastern stockholders of the Portland Gas Company have practically concluded arrangements for the sale of that property to the Electric Bond & Share Company, of New York. The price offered is said to be 30 per cent above par on the $1,950,000 of stock which has been issued.

ELECTRIC SECURITIES AT AUCTION.—At the regular auction of securities in New York last week 100 shares of New York & Queens Electric Light & Power Company, common par value $100, were sold at 65½; $10,000 Great Western Power Company first mortgage 5 per cent bonds were sold at 95½.

DIVIDENDS.

American Cities Railway & Light Company, preferred, quarterly, 1½ per cent; common, semi-annual, 1½ per cent, both payable Jan. 1.

Bangor (Me.) Railway & Electric Company, quarterly, 1½ per cent, payable Jan. 1.

Bell Telephone Company of Missouri, quarterly, 2 per cent, payable Jan. 2.

Boston & Worcester Electric Company, preferred, semi-annual, $1 per share, payable Jan. 1.

Chicago City Railway Company, quarterly, 1½ per cent, payable Dec. 30.

Detroit Edison Company, quarterly, 1 per cent, payable Jan. 15.

Duluth Edison Electric Company, preferred, quarterly, 1½ per cent, payable Jan. 1.

Manila Electric Railroad & Lighting Corporation, quarterly, 1 per cent, payable Jan. 1.

Massachusetts Lighting Companies, quarterly, 1½ per cent, extra ¼ per cent, payable Jan. 15.

Northwestern Elevated Railroad Company, Chicago, preferred, quarterly, 1 per cent, payable Jan. 18.

Otis Elevator Company, preferred, quarterly, 1½ per cent, payable Jan. 15.

Philadelphia Company, Pittsburgh, quarterly, 1½ per cent, payable Feb. 10.

Ridge Avenue Passenger Railway Company, Philadelphia, quarterly, $3 per share, payable Jan. 1.

Tri-City Railway & Light Company, Davenport, Ia., preferred, quarterly, 1½ per cent, payable Jan. 3.

United States Light & Heat Company, preferred, semi-annual, 3½ per cent.

Westinghouse Air Brake Company, quarterly, 2½ per cent, extra 1½ per cent, special 1 per cent, all payable Jan. 10.

Westinghouse Electric & Manufacturing Company, preferred, quarterly, 1¾ per cent, payable Jan. 15.

REPORT OF EARNINGS.

| | Gross earnings. | Expenses. | Net earnings. | Charges. | Surplus. |
|---|---|---|---|---|---|
| **Chicago Railways Company:** | | | | | |
| October, 1909 | $1,109,640 | $776,748 | $332,892 | $203,626 | $129,266 |
| October, 1908 | 968,543 | 677,979 | 290,564 | 149,730 | 140,834 |
| **Cleveland, Painesville & Eastern Railroad Company:** | | | | | |
| November, 1909 | 22,900 | 15,020 | 10,880 | 8,457 | 2,423 |
| November, 1908 | 22,524 | 13,483 | 9,041 | 8,087 | 954 |
| **Cumberland Telephone & Telegraph Company:** | | | | | |
| November, 1909 | 560,032 | 306,971 | 253,061 | 40,742 | 212,319 |
| November, 1908 | 535,062 | 286,931 | 248,131 | 44,638 | 203,492 |
| **Third Avenue Railroad Company:** | | | | | |
| Quarter ended Sept. 30, 1909 | 821,132 | 415,049 | 406,083 | ..... | ..... |
| Quarter ended Sept. 30, 1908 | 786,527 | 509,331 | 277,196 | ..... | ..... |
| **Toledo Railways & Light Company:** | | | | | |
| November, 1909 | 246,185 | 126,046 | 120,139 | 75,757 | 44,565 |
| November, 1908 | 219,761 | 117,372 | 102,389 | 71,960 | 30,553 |
| **Union Railway Company of New York:** | | | | | |
| Quarter ended Sept. 30, 1909 | 567,479 | 337,509 | 229,970 | ..... | ..... |
| Quarter ended Sept. 30, 1908 | 468,873 | 340,022 | 128,851 | ..... | ..... |
| **United Railways Company of St. Louis:** | | | | | |
| November, 1909 | 927,450 | 581,014 | 346,436 | 232,107 | 114,329 |
| November, 1908 | 872,339 | 536,636 | 335,703 | 233,694 | 102,009 |

# GENERAL NEWS

## Construction News.

GLOBE, ARIZ.—An independent telephone company has secured control of the telephone system owned by the Inspiration Mining Company. It is said that the new company will install about 200 telephones in and around Miami.

PRESCOTT, ARIZ.—The Prescott Electric Light Company is reported to have entered into a contract with the Arizona Power Company for 600 hp. The Arizona company has a hydroelectric power plant at Fossil Creek.

LITTLE ROCK, ARK.—The City Council is reported to have engaged J. F. Jackson, of the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., to furnish an estimate of the cost of the proposed municipal electric light plant in Little Rock. E. A. Kingsley is City Engineer.

PARAGOULD, ARK.—The Crystal Light & Ice Company, which has been granted a 20-year franchise, contemplates improvements to its electric light plant, which will involve an expenditure of about $20,000.

CLOVERDALE, CAL.—The Board of Supervisors has granted a franchise to the Cloverdale Light & Power Company. The company proposes to distribute electricity for lamps and motors over the northern section of the county. Work on the plant will begin in the near future.

EUREKA, CAL.—The Electric Light Construction Company, of Eureka, Cal., is reported to have secured the contract to install an electric plant in the Clover Flat mine at Willow Creek.

EUREKA, CAL.—Notice of appropriation of 1500 cu. in. of water in Jacoby Creek has been filed by W. C. Elsemore, to be utilized for power and domestic purposes in the City of Eureka, Cal.

FRESNO, CAL.—The Fresno Traction Company has applied to the City Trustees for street railway franchises in this city. Two of the franchises are to replace franchises to be abandoned on present streets, and the third is a new one, which will connect Woodward's addition with the city and the projected line on J Street, making a loop around the western and southern end of the city.

LOS ANGELES, CAL.—The Los Angeles & Mt. Washington Railway Company, it is reported, contemplates the construction of a new power station after Jan. 1.

MERIDIAN, CAL.—It is reported that the Williams Alfalfa Mill Machinery Company is contemplating the erection of an alfalfa meal mill in Meridian, Cal. It is said that the plant will be equipped for electrical operation.

MODESTO, CAL.—The La Grange Light & Water Company has decided to make some improvements to its substation in Modesto. Work on the erection of its transmission line is being rushed to completion. John Coffee Hays is vice-president and manager of the company and V. H. Chrisman is construction engineer, both of Visalia, Cal.

OROVILLE, CAL.—The Board of Supervisors has passed the ordinance granting a franchise to the Sacramento Valley Power Company to furnish electricity in Oroville.

PASADENA, CAL.—The Edison Electric Company, of Los Angeles, has announced a new schedule of charges for electricity, as folows: To consumers using 2000 kw or over per month, 2¾ cents per kw-hour; 3¾ cents for over 1000 and less than 2000 kw per month; 4½ cents for over 500 and less than 1000 kw per month; 4¾ cents for over 100 and less than 500 kw per month, and 5 cents per kw for 100 kw or under. The city recently reduced the price of electricity supplied by the municipal electric plant to 3 cents per kw-hour to large consumers and 7 cents to small ones. When the city built the municipal plant the Edison company charged 12½ cents per kw-hour.

REDWOOD CITY, CAL.—It is reported that preliminary surveys are being made for an electric railway from Redwood City to Woodside, La Honda and Big Basin. A. H. Lohman, of San Francisco, Cal., is said to be interested in the project.

SANTA BARBARA, CAL.—Plans are being made to improve the old Merchants Mutual plant in Santa Barbara and bring it up to the standard of the plant now known as Edison No. 1.

SAN DIEGO, CAL.—A movement is on foot to replace the present arc lamps on Fifth Street between A and H streets with incandescent lamps placed on ornamental posts, and extend the system from Ash Street to the foot of Fifth Street.

SAN FRANCISCO, CAL.—Preparations are being made to commence work the first of the year on the construction of an electric railway from Oakland to Berkeley, Walnut Creek, Concord and Bay Point, 34 miles in length, for which surveys and final locations have been made. Electricity to operate the road will be purchased. The present plans call for the purchase of four cars and one electric locomotive. H. A. Mitchell, of San Francisco, Cal., is president.

BOULDER, COL.—The City Council is considering the question of utilizing the water power in connection with the city pipe line, which leads from the intake on the Boulder County ranch to this city, for which bonds to the amount of $40,000 were voted last spring. Surveys are being made and estimates are being prepared for the work.

DENVER, COL.—We are informed that there is no truth in the reports that the transmission line of the Central Colorado Power Company between the Shoshone tunnel and Denver, was badly damaged and would have to be rebuilt, as published in these columns Dec. 16. G. H. Walbridge, general manager of the company, states that the line has not been damaged further than the momentary swinging short circuits, resulting from the combined results of cold weather, heavy sleet and high winds, which occurred simultaneously on Argentine Pass and were easily remedied as soon as located.

DORCHESTER, COL.—An electric light and power plant is being installed for the United Colorado Mines Company, at Dorchester, Col. The equipment will include a 200-kw, three-phase, 2300 volt General Electric generator. The plant will be driven by a Pelton water wheel. Electricity will be transmitted from the power house to the mine, a distance of 2½ miles. About eight three-phase General Electric induction motors from 3 hp to 75 hp will be used in the concentrating mill, compressor house, etc. The company also furnishes electricity for lighting the mine and several buildings. The plant was installed by D. L. Solomonson, an electrical engineer, of Denver, Col.

LA SALLE, COL.—Preparations are being made for electrical service in La Salle, in anticipation of the extension of the transmission lines of the Home Electric Lighting Company, of Greeley, Col., which are already being rapidly constructed to Evans. The line will be operated at 6600 volts for the present, supplying both La Salle and Evans.

PUEBLO, COL.—The Pueblo & San Luis Railroad Power Company contemplates asking for a franchise to operate a street railway system on some of the principal streets in Pueblo.

PUEBLO, COL.—Mayor Fugard has sent an important communication to the City Council, recommending that the number of lamps be cut down from 350 to 150, as provided by contract, and that the money paid for the 200 lamps be used to install 500 gas arc lamps for street lighting. He also recommended that the city give serious consideration to the offer of the Pueblo & Suburban Traction & Lighting Company to furnish 100 lamps free for two years. The gas company offers at its own expense to install the gas lamps and supply the same number of lamps at nearly one-half the price demanded by the electric company, which would result in a saving of $15,000 per year. The city now pays $87.50 per lamp per year. The entire matter has been referred to a committee.

HARTFORD, CONN.—The capital stock of the Manila Electric Railroad & Lighting Corporation of Hartford has increased its capital stock from $6,000,000 to $8,000,000.

SAYBROOK, CONN.—The power house of the Shore Line Electric Railway Company is nearly completed, the equipment of which will include two 1500-kw, three-phase, 25-cycle, 11,000-volt Curtis steam turbo-generators. Provision has been made for the installation of two additional units of the same size in the future. Electricity generated at this station will be transmitted to two substations, one located in the car barn at Saybrook, and the other in Guilford, each of which will be equipped with three 200-kw, 600-1200-volt rotary converters. The cars will enter New Haven over the tracks of the Connecticut Company.

NEW CASTLE, DEL.—The American Power Company has applied to the levy court for permission to erect transmission lines from New Castle to Delaware City for the purpose of furnishing electricity for lamps. The levy court adopted a resolution granting the franchise, but included a clause requiring the company to provide 10 incandescent lamps of 32 cp per mile along the road to be kept in service every night. T. Bayard Heinsel is counsel for the company.

PENSACOLA, FLA.—The Dallas Land Company has applied to the City Council for a franchise for an extension of the North Hill street car line. The company proposes to build the railway and to pay the cost of operation until the line is on a paying basis, at which time the Pensacola Electric Company agrees to take it over.

DUBLIN, GA.—The City Council has granted the Dublin Street Railway Company a franchise, subject to certain conditions. It is said all necessary capital will be raised in Dublin.

GREENVILLE, GA.—Bids will be received by the Mayor and Council of Greenville, Ga., until Jan. 4 for the purchase of bonds to the amount of $30,000, of which the proceeds of $8,000 will be used for the construction of an electric light plant and $16,000 for water works and the remainder for sewer system. C. R. Williams is Mayor.

LA FAYETTE, GA.—W. A. Wardlaw, city recorder, writes that at an election to be held March 15, 1910, the proposition to issue bonds for the construction of an electric light plant will be voted on.

MACON, GA.—The Macon Railway & Light Company, it is reported, proposes to make improvements to its system during the coming year, including the completion of its railway out the Columbus road; extending the South Macon line one mile, and the extension of the East Macon line a distance of one mile.

STATESBORO, GA.—We are informed that plans are being considered for the installation of another dynamo and engine in the municipal electric light plant next season. H. B. Davis is manager.

TALLULAH FALLS, GA.—Louis Magid, of Tallulah Falls, is interested in a project to construct an electric railway from this town to his cement works, four miles distant.

WAYCROSS, GA.—A deposit of $10,000 has been made by Burdette Loomis, Jr., of Hartford, Conn., with the City Council to guarantee the carrying out of the franchise for the construction of an electric lighting plant in Waycross, work on which is to start within three months and is to be completed within one year. The company proposes to reduce the cost of electricity for lighting and gas about 35 per cent. A rate of $1 per 1000 cu. ft. for gas is promised.

KOOSKIA, IDAHO.—It is reported that Bates & Rogers, of Spokane, Wash., have secured the contract for construction of the concrete dam across the middle fork of the Clearwater River at Kooskia. The dam will furnish power to operate a plant which will furnish power in connection with large industrial improvement to be made in Kooskia by Chicago capitalists. The project will include the dam, power plant, cement factory and saw mill, calling for an expenditure of $1,500,000. Plans are also being considered for a large pulp mill. W. J. Bell, of Denver, Col., is said to be interested in the enterprise.

CHICAGO, ILL.—The Independent telephone companies which propose to establish a telephone service in Chicago have pledged $50,000 for the purpose. The stock of the reorganized body will be sold to the members of the International Independent Telephone Association, either to companies or individual stockholders in each company, and from this a fund of $1,000,000 will be obtained to finance the new service for Chicago alone. Contracts have been entered into for the construction of the plant and a guarantee has been given that the service will be in operation during the coming year. The system will connect 250,000 telephones within a radius of 500 miles of Chicago. The reorganization committee includes H. D. Critchfield, of Chicago, Ill.; Frank H. Woods, of Lincoln, Neb.; Theodore Gary, of Macon, Mo.; Mansford Savage, of Champaign, Ill., and Joseph B. Ware, of Chicago, Ill.

EVANSTON, ILL.—The City Council has renewed the contract for street lighting with the North Shore Electric Company for a period of ten years. The contract calls for alternating-current, 432-watt enclosed arc lamps, of which 375 will be installed at first; the number will be increased later. Under the terms of the contract the city is to pay $10 each per year more for lamps supplied from the underground service than for those furnished on overhead circuits. This proposition was accepted after a careful consideration on part of the city authorities, who agreed that it was a fair arrangement.

ROCK ISLAND, ILL.—The Central Union Telephone Company has submitted an ordinance to the City Council asking for a 25-year franchise and providing for the rebuilding of its present plant, including the placing of all its wires underground from Thirteenth to Twenty-fourth streets and First to Seventh avenues. If the franchise is granted the company proposes to expend about $150.000.

BRAZIL, IND.—Application has been made to the Commissioners of Clay County by the Terre Haute, Indianapolis & Eastern Traction Company for a franchise to erect a transmission line through Harrison and Lewis townships. It is understood that the proposed line will furnish electricity to smaller towns in the southern part of the county for lamps.

DELPHI, IND.—The Logansport, Frankfort & Indianapolis Traction Company, of Logansport, has applied to the County Commissioners for a franchise to operate its proposed electric railway over the Michigan road in Washington, Burlington and Carrollton townships. A. A. Newer, of Logansport, Ind., is interested in the project.

ELKHART, IND.—A company to be known as the Elkhart Gas Power Company is being formed to compete with the Indiana & Michigan Electric Company. The organization of the company, it is stated, is a result of the recent increase in rates of the Indiana & Michigan Electric Company, to go into effect after Jan. 1. A large number of manufacturers are back of the project, and it is proposed to equip a plant to supply electricity for power exclusively and later to branch out when conditions warrant it. The proposed plant will be equipped with gasoline engines. C. E. Fry, of the Elkhart Bristol Board Mill Company, has charge of organizing the company.

EVANSVILLE, IND.—Charles A. Gillham, secretary of the Evansville Public Service Company, announces that more than one-half of the $1,000,000 necessary to build its proposed plant has been pledged and that contracts for construction of the plant will soon be let.

FORT WAYNE, IND.—At the request of the Board of Public Works an ordinance has been introduced in the City Council appropriating $50,000 for the purpose of installing an additional 1200-kw turbo-generator unit in the municipal electric light plant.

LOGANSPORT, IND.—At a meeting of the stockholders of the Logansport & Frankfort Traction Company, held recently, arrangements were made for the reorganization of the company, by which the Cleveland Construction Company was taken into the organization. It is said that work will commence on the construction of the road within 90 days. The people of Clinton, Carroll and Cass counties have voted substantial subsidies in aid of the project.

OAKLAND CITY, IND.—The Oakland City Light & Power Company has increased its capital stock by $15,000, the proceeds to be used for improvements, extensions, etc. C. W. McLaughlin is president, and Henry Christmas, secretary.

RICHMOND, IND.—It is reported that the new administration which will take control Jan. 1 will purchase the local water-works system and operate it in connection with the municipal electric plant. It is proposed to equip the water plant to be operated by electricity supplied from the municipal plant.

SEYMOUR, IND.—The temporary injunction restraining the City Council from entering into a contract for lighting the city with the Indiana Public Utilities Company has been dismissed by agreement, the matter to be left to the new Council, which takes control Jan. 1. Three companies are bidding for the contract.

BOONE, IA.—Announcement has been made that Messrs. Hughes, McBride and Stevenson, of the Iowa Light & Traction Company, who were granted a franchise in August to furnish electrical service and operate a heating plant in this city, have broken off negotiations for the purchase of the Reynolds property in Boone, and the franchises will be turned back to the city. It is said that Mr. Reynolds will rebuild and improve the properties and ask for a new franchise at the expiration of the present one in 1913.

FORT DODGE, IA.—L. S. Cass, president of the Waterloo, Cedar Falls & Northern Railway Company, of Waterloo, Ia., is reported to be interested in a project to construct an electric railway to connect Mason City, Waterloo and Fort Dodge.

POSTVILLE, IA.—The transmission line of the Upper Iowa Power Company of Decorah, Ia., to extend from its plant at Lake Oneota to Postville, is nearly completed. The company expects soon to be ready to furnish electricity for lamps and motors in Postville.

ALTAMONT, KAN.—The Kansas Union Traction Company is planning to construct an electric railway from Parsons to Coffeyville, Columbus, Oswego, Altamont, Mound Valley and Cherryvale, 90 miles in length. The power plant and repair shops will be located in Altamont. The company proposes to furnish electricity for lamps, heat and motors. It is expected to begin work about the first of the year. William J. Jones, of Altamont, Kan., is president of the company.

ERIE, KAN.—J. C. Denious, city clerk, writes that owing to delay on account of making tests of water supply, bids for construction of electric light plant and water works system will not be opened until Jan. 15 or 20, instead of Dec. 15 as stated in these columns Nov. 25. Burns & McDonnell, Scarrett Building, Kansas City, Mo., are engineers.

VINE GROVE, KY.—Plans are being considered to organize a company to establish an electric light plant in Vine Grove. C. Bewley and Richard Wilkerson are interested in the project.

CROWLEY, LA.—The City Council has adopted a resolution providing for submitting the proposition to issue bonds for the construction of a municipal electric light plant and water works system to a vote of the people.

MANDEVILLE, LA.—It is reported that work will soon commence on the construction of the proposed light and ice plant of the Mandeville Electric Light & Ice Company.

PLAQUEMINE, LA.—R. E. Dunlap, representing the electric light company, has notified the City Council that it proposes to rebuild the electric light plant at once. He also asked for a franchise for a new water works system, agreeing to furnish water to the town at 15 cents per 1000 gal., the town to take not less than 3,000,000 gal, per month. The plant and equipment was destroyed by fire Nov. 1. The franchise and property was purchased at auction by J. H. Pugh for $8,500.

FREEPORT, MAINE.—A. W. Shaw Company has entered into a contract with the electric light company at Yarmouth to furnish electricity to operate part of its factory.

PEMBROKE, MAINE.—The Pennamaquan Light & Power Company has applied for a franchise to extend its transmission lines from Pembroke to West Pembroke. Later, it is said, the system will be extended to other nearby towns.

PORTLAND, MAINE.—The Portland Power & Development Company has purchased the property known as the Damariscotta plant of the Centrifugal Leather Board Company. It is said the company will develop the water power to generate electricity for transmission to Boothbay, Maine.

PORTLAND, MAINE.—Bids will be received at the office of the constructing quartermaster, 655 Congress Street, Portland, Maine, until Jan. 20, for the construction and remodeling of an electric lighting system at Fort William, Maine, plans and specifications of which are on file in the office of the chief quartermaster, Department of the East, Governor's Island, N. Y., and the office of the constructing quartermaster, 263 Summer Street, Boston, Mass. Plans, specifications, blank forms for proposals, etc., furnished upon application. A deposit will be required for plans to insure safe return of the same. Captain C. F. Humphrey, Jr., is constructing quartermaster.

ELKTON, MD.—The dam across the Big Elk Creek, owned by the Cecil Heat, Light & Power Company, was recently destroyed by the freshet, putting the hydroelectric plant of the company out of business. The dam was built about two years ago.

HAVERHILL, MASS.—The City Council is considering the question of purchasing the gas and electric light plants and systems in Haverhill. The gas plant is owned by the Haverhill Gas Company and the electric plant by the Haverhill Electric Company. The project will involve an expenditure of $1,500,000.

LYNFIELD CENTRE, MASS.—Buildings are being erected by the Saugus River Peat Company in Lynnfield Centre, which will be used as experimental stations by the company for the purpose of reducing the cost of generating electricity. The purpose of the company is to use certain fuels, among them peat, and if successful other plants will be established in various parts of the country.

REVERE, MASS.—The Suburban Gas & Electric Company, of Revere and Winthrop, has applied to the State Gas and Electric Light Commissioners for permission to issue additional capital stock to the amount of $165,000, the proceeds to be used to pay off a floating debt and to meet the cost of permanent improvements.

SOUTH WALPOLE, MASS.—The Massachusetts Railroad Commissioners have approved of the issue of the Norfolk & Bristol Street Railway Company's $50,000 5 per cent equipment bonds.

WORCESTER, MASS.—The transforming station of the Connecticut River Transmission Company in Greendale, Mass., was destroyed by fire Dec. 12, causing a loss of about $25,000. It is said the plant will be rebuilt at once and new machinery installed and that the company will be delayed but a short time in furnishing electricity in Worcester..

ATHENS, MICH.—The local electric light plant, owned by the Athens Electric & Power Company, was destroyed by fire Dec. 12, causing a loss of about $5,000.

CHESANING, MICH.—The Town Council is contemplating the erection of a hydroelectric plant on the Shiwassee River to furnish electricity to operate the municipal electric light plant and water works system.

SAGINAW, MICH.—Preparations are being made by the Saginaw & Flint Railway Company to begin work in the near future on its proposed extension to Vassar. Charles Arnold is superintendent.

SAGINAW, MICH.—The City Council and the Chippewa River Power Company have come to terms as to the rates to be charged in this city for electricity. The Council has granted the company a franchise. The price agreed upon is four cents per kw-hour for the first 75 kw and 2½ cents for all in excess of that amount. W. F. Davidson, of Port Huron, Mich., is vice-president of the company.

TRAVERSE CITY, MICH.—L. K. Gibbs is reported to be interested in a project to build a street railway in Traverse City, work on which will commence as soon as a franchise is obtained. It is said that surveys have already been made and rights of way secured.

ANOKA, MINN.—The Great Northern Development Company, which proposes to construct a large dam at Anoka in connection with a hydroelectric development has purchased 5½ acres of land as part of the site for its proposed plant.

FERGUS FALLS, MINN.—The Otter Tail Power Company, of Fergus Falls, Minn., is reported to have secured contracts to supply electricity for lamps and motors in Breckenridge and Wahpeton, 25 miles distant.

MINNEAPOLIS, MINN.—The City Councils of Minneapolis and St. Paul, Minn., have adopted resolutions pledging the payment of the $300,000 necessary for the construction of an additional 15 ft. on the lower Government dam just above the soldiers' home, the amount to be shared equally between the two cities. It is proposed to raise the dam from 15 to 30 ft. It is estimated by the Government engineers that 15,000 hp can be generated, the power to be disposed of between the two cities, the Government reserving only 1000 hp to supply Fort Snelling and the Federal buildings in St. Paul. As yet no plans have been made for distributing or utilizing the power.

MIZPAH, MINN.—The local electric light plant owned by W. A. Potter has been destroyed by fire, causing a loss of about $4,000.

ST. PAUL, MINN.—Bids will be received by the Minnesota State Board of Control, State Capitol, St. Paul, Minn., until Feb. 7, 1910, for the erection and completion of new buildings and improvements for the Minnesota State Prison, at Oak Park, Stillwater, Minn., in accordance with drawings and specifications prepared by Clarence H. Johnston, architect, 715 Manhattan Building, St. Paul, Minn., and Charles L. Pillsbury, consulting engineer, 805 Metropolitan Life Building, Minneapolis, Minn. Proposals will be received: First—for the entire work; Second—For parts of the work as follows: "A," for the entire mechanical equipment, including water, sewer and electric work, power plant, heating, ventilating and plumbing work; "B," for inclosing walls, guard house towers and entrance gates; "C," for power house building, factory and warehouse buildings; "D," balance of the work. Proposals must be prepared and submitted only on forms furnished by the architect and consulting engineer. No other forms will be considered. Copies of above plans and specifications may be seen at the Builders' Exchange, at St. Paul, Minn.; Builders' Exchange, Minneapolis, Minn.; Builders' Exchange, Duluth, Minn.; at the office of the State Board of Control, State Capitol Building, St. Paul, Minn.; Warden's office, State Prison, Stillwater, Minn.; Builders' Exchange, Chicago, Ill.; Builders' Exchange, Omaha, Neb.; Builders' Exchange, Kansas City, Mo., and at the Building Trades Employers' Association, New York City, N. Y. Extra copies of drawings and specifications may be obtained on application at the office of the architect or the consulting engineer on payment of cost of duplication as follows: For the entire work, $648; for mechanical equipment, $280; for inclosing walls, guard house towers and entrance gates, $56; for power plant building, factory and warehouse buildings, $112, and for remainder of work, $200, which will be returned to the bidders on return of the plans in good condition, less the amount which will be retained to cover the cost of duplicating the plans. Charles Halvorson is chairman of State Board of Control.

RULEVILLE, MISS.—The electric plant of the Ruleville Light, Ice & Coal Company was entirely destroyed by fire Dec. 13, causing a loss of about $9,000.

KANSAS CITY, MO.—At an election held Dec. 16 the proposition to grant the Metropolitan Street Railway a 42-year franchise was defeated. The company has a franchise which still has 16 years to run, but the company proposed to have it extended to 42 years, offering in return six tickets for a quarter, sold on the cars, and 25 tickets for a dollar, sold in drug stores in the two Kansas Cities.

BILLINGS, MONT.—The transmission lines of the Madison River Power Company, of Butte, Mont., have been extended as far as Big Timber, and plans for the extension of the line to Laurel, where they will connect with the lines of the Billings & Eastern Montana Company are now under way. It is expected to have the system extended to Billings by next spring.

BOZEMAN, MONT.—Thaddeus S. Lane and associates, acting for the Interstate Consolidated Telephone Company have purchased from J. S. Haley, of Bozeman, Mont., all the independent telephone lines with terminals at Logan and lines extending from Livingston to Gardiner, Bozeman to Salesville and Bozeman to Chimney Rock.

HAMILTON, MONT.—Preparations are being made by the Hamilton Light & Water Company for the construction of a hydroelectric plant to furnish electricity in Hamilton. Contracts for the work will be awarded as soon as plans and specifications are completed. The plant will be located on Sleeping Child Creek at a point about six miles from this city. The cost of the plant is estimated at about $150,000 and from 1500 to 2000 hp will be developed. W. O. Fisk is interested in the company.

LIBBY, MONT.—The Civic and Booster Club is agitating the question of establishing a municipal telephone system in Libby.

HASTINGS, NEB.—Improvements are being made to the municipal electric light plant, which include the installation of a new 500-kw turbo-generator set, cooling tower, condenser, etc., at a cost of about $18,000 A. T. Bratton is city clerk.

OMAHA, NEB.—Plans are being made for extensive improvements to the Nebraska Telephone Company's plant in Omaha, which will involve an expenditure of about $200,000. Orders have been placed for a switchboard capable of handling 10,000 telephones.

WEST STEWARTSON, N. H.—A new boiler is being installed in the plant of the William F. Allen Electric Company.

ATLANTIC CITY, N. J.—The Reading Railway Company has awarded a contract to the Federal Signal Company, of New York, N. Y., for the construction of a mechanical interlocking signal plant at Atlantic City, N. J.

AZTEC, N. M.—It is expected that electrical service will be furnished in Aztec by Jan. 1. The service will be supplied from the large hydroelectric plant on the La Plata River. Aztec and Denver capitalists are building an irrigation system on the San Juan River, which will cover several thousand acres of fine fruit land. The contract for the construction of the Illinois ditch, which will reclaim 12,000 acres west of Aztec, will be let by the first of the year. By April 1 the La Plata Land & Irrigation Company will finish the first of a series of reservoirs which will reclaim 10,000 acres.

BROOKLYN, N. Y.—The Public Service Commission has given the Kings County Electric Light & Power Company permission to withdraw its petition for permission to issue $5,000,000 in convertible bonds and to submit an amended one, in which the company will ask for permission to issue $2,500,000 in construction bonds and $2,500,000 of reimbursement bonds. It is understood that the commission will approve the issue of the construction bonds, but it is questioned as to whether it has the right to approve an issue of bonds to reimburse the company for work that has already been done.

BUFFALO, N. Y.—County Engineer Diehl in a communication to the Board of County Supervisors recommends that a new boiler house for the penitentiary be built in a more advantageous location and at least three 150-hp boilers and an additional 75-hp engine be provided. The cost of the plant is estimated at from $35,000 to $40,000.

JAMAICA, N. Y.—The New York & North Shore Railroad Company is acquiring the necessary right-of-way for laying a second track between Jamaica and Flushing. Work, it is said, will begin on construction of the track in the spring.

LYONS, N. Y.—The Wayne County Electric Company, which was recently purchased by William T. Morris, of Penn Yan, will be taken over by the United States & Gas & Electric Company, having headquarters at Penn Yan. The company will be operated under its own name and as a separate company. Only temporary improvements will be made at present. The new owners propose to rebuild entirely and remodel the plant in the spring. The new officers of the company are: William T. Morris, of Penn Yan, president and treasurer, and Morris Tracy, of Penn Yan, secretary.

NEW YORK, N. Y.—Judge Lacombe, of the United States Circuit Court, has authorized the receivers of the Metropolitan Street Railway Company to construct a double-track electric railway on Canal Street between Centre Street and the Bowery. This permit will give the company access to the new Manhattan Bridge.

ROUND LAKE, N. Y.—The question of establishing an electric light plant in Round Lake is under consideration.

APEX, N. C.—The city is reported to have awarded a contract to the Carolina Electrical Company, of Raleigh, N. C., for the installation of an electric lighting system, the contract to include power equipment, arc and tungsten street lamps, incandescent lamps, transformers, meters and inside wiring materials.

HICKORY, N. C.—Bonds to the amount of $850,000 are being offered for sale by Col. M. E. Thornton, president of the Thornton Light & Power Company and the Hickory Water Power Company, the proceeds to be used for the development of a hydroelectric project by the Hickory Water Power Company, by which it is estimated that 9000 hp can be developed.

MONTEZUMA, N. C.—The Montezuma Bobbin Company is reported to be in the market for electrical equipment.

REIDSVILLE, N. C.—The construction of the new power house for the municipal electric light plant is under way, and three boilers with a rating of 375 hp will be installed.

SALISBURY, N. C.—Extensive telephone connections are being built by the independent telephone interests from Salisbury to Lexington, Concord and other towns. The telephone company is endeavoring to secure a franchise in Spencer.

GRAND FORKS, N. D.—The City Council is reported to have decided to proceed with the installation of complete electrical equipment at the municipal electric plant for the purpose of furnishing electricity for street lighting and commercial service.

CANAL DOVER, OHIO.—The City Council is reported to be considering an additional bond issue for $15,000, the proceeds to be used for the purchase of more machinery for the municipal electric light plant.

CLEVELAND, OHIO.—Plans are being prepared by the George S. Rider Company for the construction of a large power plant for the Peerless Motor Company early next spring. The plant will have an output of from 2000 to 3000 kw. It is said that contracts will be placed for boilers, engines, generators, etc., as soon as plans are completed.

MASSILLON, OHIO.—Plans are being considered by the Massillon Electric & Gas Company for the reconstruction of its entire plant, work on which will begin soon after the first of the year. The company proposes to increase the output of its plant so as to be able to supply electricity for motors. Several of the local companies are contemplating the installation of electrical power to operate their plants. R. R. Choate is general manager.

MOUNT VERNON, OHIO.—The new owners of the Mount Vernon Railway & Light Company, it is said, will soon begin work on improvements to the property, which will include the construction of a new power house, the purchase of new cars and other improvements. The property has been in the receivers' hands for many months and was purchased some time ago by N. C. L. Kackelmacher, of Columbus, Ohio, and New York capitalists.

NAVARRE, OHIO.—The Massillon Electric & Gas Company has applied to the Town Council for a franchise to install and operate an electric system in Navarre. The company proposes to supply electricity for street and residential lighting and power purposes. The Navarre Light Company now has the franchise.

NILES, OHIO.—The Hydro-Electric & Gas Company, of Warren, Ohio, which has a contract to furnish the municipal electric light plant with electricity, will erect an auxiliary plant near the present municipal power plant to provide additional power to meet the increased demand for electrical service. Superintendent Holloway has been instructed to place meters on commercial, light and street circuits, also on the line for the air compresssors at the city lighting plant.

WILMINGTON, OHIO.—A company has been incorporated in Wilmington by A. J. Bailey, J. R. Clevenger, M. R. Denver, R. L. Owens and J. W. Lawhead for the purpose of constructing an electric light and power plant in Wilmington. The company proposes to furnish electricity to the Champion Bridge Works, the Augur Bit Works and other manufacturing interests in which the incorporators are interested.

WOOSTER, OHIO.—The capital stock of the Wayne County Telephone Company has been increased from $10,000 to $100,000.

ZANESVILLE, OHIO.—The Zanesville & Meigs Valley Company, it is reported, will on May 1 place the contract for the construction of its proposed railway down the valley from Zanesville to Beverly. In addition to the route first proposed the company will build a branch line to McConnellsville, eight miles long. The company also proposes to construct a 24-mile extension from Beverly to Parkersburg later.

FORT GIBSON, OKLA.—It is reported that surveys are being made by Charles B. Haggerty, engineer, on the Grand River, near Fort Gibson, for the H. M. Byllesby Company, of Chicago, Ill., which is contemplating the construction of a large hydroelectric power plant to generate electricity for transmission to a number of cities in Oklahoma.

MUSKOGEE, OKLA.—The isolated electric plant owned by G. W. Barnes, of Muskogee, was destroyed by fire on Dec. 12.

OKLAHOMA CITY, OKLA.—J. B. Taylor & Company, of New York, N. Y., are reported to have secured the contract for the engineering work in connection with the construction of the electric railways between Oklahoma City and Shawnee, Okla.

RALSTON, OKLA.—All bids received Dec. 15 for material and construction of a complete electric light plant and water-works system for Ralston were rejected, and new bids will be received Jan. 17. The work will include well, building, triplex power pumps, alternating-current generator, oil engine, steel tank and tower, poles, wire, cast-iron pipe, etc. Bids will also be received at the same time for the purchase of $25,000 in bonds. M. A. Earl & Company, of Muskogee, Okla., are engineers. T. E. Bryant is city clerk.

ASTORIA, ORE.—The Astoria, Seaside & Tillamook Railway Company is advertising for bids for the construction of its proposed railway from Smith's Point to Young's Bay Bridge. The company proposes to construct an electric railway from Astoria, Seaside and Tillamook, for which rights-of-way have been secured as far as Seaside, and franchises have been secured over the streets of Astoria and Seaside. The plans also provide for a branch line from Warrenton, Hammond and Fort Stevens. F. L. Evans is president.

KLAMATH FALLS, ORE.—Plans are being considered for equipping the local street car system, to be operated by electricity. It is stated that work will commence early in the spring.

MARSHFIELD, ORE.—At a special election held recently the citizens voted to grant a franchise to J. M. Blake to construct and operate an electric railway in Marshfield. The proposed railway will be about five miles long.

OREGON CITY, ORE.—It is reported that F. M. Smith, who is promoting the proposed Oregon City, Beaver Creek & Molala Railway, has secured stock subscriptions amounting to $100,000. The railway will extend from Oregon City to Silverton. It is said that work will commence at once on construction of the road.

PENDLETON, ORE.—Arrangements have been made between a committee of Pendleton business men and the representative of the Washington-Oregon Traction Company for the construction of an electric railway in Pendleton. Under the agreement the residents of Pendleton are to purchase $50,000 in capital stock of the company, in return for which the company agrees to build six miles of street railway in Pendleton and the suburbs within one year, the cars to be operated by gasoline motors to begin with, but to be equipped for electrical operation within two years. The company secured a franchise in this city 14 months ago and must build at least three miles of line in Pendleton within the next four months to comply with the franchise. The Washington-Oregon Traction Company proposes to develop 800 hp on the south fork of the Walla Walla River.

PORTLAND, ORE.—Bids will be received by the City of Portland, Ore., until Jan. 3, 1910, for the construction of a garbage incinerator. Bidders are also asked to submit estimates on the cost of the installation of a 500-hp steam generating plant to be operated in connection with the incinerator. Dr. C. H. Wheeler is city health officer.

PHILADELPHIA, PA.—The Pennsylvania Equipment Company, West End Trust Building, Broad & South Penn. Square, Philadelphia, Pa., is reported to be in the market for a 300-kw, alternating-current, three-phase, 60-cycle generator, with engine of sufficient rating to drive the same.

PITTSBURGH, PA.—The contract for installing an electric lighting plant for the Mission Street pumping station was awarded to the Dravo-Doyle Company, of Pittsburgh, Pa., for $2,300.

WILKES-BARRE, PA.—The Wilkes-Barre Street Railway Company, recently incorporated, has secured a lease of the Wilkes-Barre & Wyoming Valley Traction Company for a long term of years. By this deal the local interests again secure control of the road.

CANTON, S. D.—Owing to the City Council and the Canton General Electric Company being unable to come to an agreement in regard to the renewal of the street lighting contract the streets of the city have been in darkness since Dec. 4. The company, it is said, refuses to enter into a short term contract with the city.

DUNSEITH, S. D.—It is reported that John Gottbrecht contemplates the construction of an electric light and water power plant at Mineral Springs in the spring.

FLANDREAU, S. D.—The question of establishing an electric light plant in Flandreau is under consideration.

MEMPHIS, TENN.—Bids will be received until Dec. 27 by the Board of Education, Memphis, Tenn., for heating and ventilating, automatic temperature regulation, power plant motors and switchboard, electric wiring and conduits to be installed in the high school building now under construction. Plans and specifications may be secured from B. C. Alsup & Company, architects, Memphis, Tenn., or of J. H. Brady, designing engineer, Kansas City, Mo. Bidders will be required to make a deposit of $25 for plans. Proposals must be made on forms furnished by the designing engineer.

CALVERT, TEX.—The Calvert Water, Ice & Electric Light Company has engaged Louis Block, 45 East Forty-second Street, New York, N. Y., to take charge of the construction of its plant.

GAINESVILLE, TEX.—It is reported that the Gainesville Electric Company contemplates improvements to its plant, which will involve an expenditure of about $50,000.

HOUSTON, TEX.—Arrangements are being made by the Houston Lighting & Power Company for placing its wires underground within the fire limits in the City of Houston, work on which will begin about Jan. 1. About three years will be required to complete the work, which will cost approximately $300,000. Ford, Bacon & Davis, of New York, N. Y., have charge of the work.

McKINNEY, TEX.—The Lone Star Cotton Mill Company is planning to construct a 5000-spindle mill, which will be equipped with sprinkler system for fire protection, producer-gas plant, dynamo, motors, etc. It is said that bids for construction will be received about Jan. 1. The company is capitalized at $200,000. J. Perry is president.

MINERAL WELLS, TEX.—The contract for the construction of an interurban railway from Fort Worth over the northern route to Mineral Wells has been signed by the interurban committee of Mineral Wells and Judge James Watkins and Paul Hurley, of Fort Worth, promoters of the Mineral Wells & Northwestern Railway Company, which was recently incorporated to construct the railway.

MOBEETIE, TEX.—The J. B. Taylor Company, 30 Church Street, New York, N. Y., is reported to have secured the contract for 125 miles of engineering work for the Central Construction Company, of Mobeetie, Tex.

COALVILLE, UTAH.—Application has been filed with the state engineer by Moses W. Taylor, of Coalville, for permission to appropriate 20 cu. ft. per second of water from Chalk Creek, Summit County, to be utilized to generate electricity for transmission to various towns in Utah. The water will be carried through a ditch 18,000 ft. in length and 500 hp will be developed.

FREMONT, UTAH.—The Utah Gold & Copper Mines Company has filed an application with the state engineer for water rights on the south fork of Atchinson Creek, to be utilized for the development of power, to be used for motive power in its mines at Fremont.

MARYSVILLE, UTAH.—Application has been made to the state engineer by Thomas Ferguson, of Salt Lake City, for appropriation of 15 second ft. of water from Pine Creek in Plute County, to be utilized to generate electricity for distribution in Marysville.

RICHFIELD, UTAH.—The Belknap Company is reported to have engaged J. Jensen as consulting engineer in connection with the installation of its proposed electric plant.

SALT LAKE CITY, UTAH.—Application has been made to Caleb Tanner, state engineer, by L. B. McCornick for 15 cu. ft. of water from Hard Scrabble Creek, Morgan County, to be utilized to generate electricity for lighting purposes. The application specifies a dam and a channel 6600 ft. in length, the water wheels to operate under a head of 105 ft., developing 140 hp.

LYNCHBURG, VA.—The Roanoke Electric Light & Power Company has secured a large tract of land and water rights along the Staunton River in the vicinity of the town of Brookneal, where it proposes to erect a large hydroelectric power plant. It is estimated that 5000 hp can be developed, which will be transmitted to Lynchburg and other places, to be utilized for lamps and motors. The company is capitalized at $1,000,000. Judge E. D. Newman, of Woodstock, Va., is president, and L. T. Stoneberger is secretary and treasurer of the company.

RICHMOND, VA.—Plans for the transmission lines for the municipal electric light plant have been approved, and the committee on electricity has been authorized to advertise for bids for the transmission system in connection with the plant as soon as funds are available. E. W. Trafford is consulting engineer.

STAUNTON, VA.—The Trustees of the Virginia School for Deaf and Blind have decided to petition the Legislature for an appropriation to install an electric light plant at the school to cost $10,000.

GRANITE FALLS, WASH.—The Granite Falls Electric Company has filed a petition with the Board of County Commissioners of Snohomish County asking for a franchise to erect transmission lines over the roads and highways of the county for the transmission of electricity for all purposes, also for a pipe line for water to be supplied for both public and private purposes.

MONTESANO, WASH.—The County Commissioners have granted Eldredge Wheeler a 50-year franchise to construct an interurban railway over the county roads. The franchise calls for the construction of a railway from Moclips on the sea beach to Gate City.

SEATTLE, WASH.—The Seattle Electric Company has been granted two franchises to construct new street car lines on Sixth Avenue Northwest and on Fourteenth Avenue.

SPOKANE, WASH.—The output of the Nine-Mile power plant on the Spokane River, located nine miles below Spokane, is to be increased from 10,000 hp to 20,000 hp. Contracts for machinery amounting to $110,000 have been awarded to the Westinghouse Electric & Manufacturing Company. The plant furnishes electricity for operating the city and interurban systems of the Spokane & Inland Empire Railroad Company.

YACOLT, WASH.—The City Council has granted J. M. McIntire and Edward McIntosh a franchise to furnish electricity for lamps and motors in Yacolt. Under the terms of the franchise service is to be established in the city within 60 days from the acceptance of the franchise. A steam plant will be installed at first. It is proposed to utilize the water power at Twin Falls on Cedar Creek, where it is estimated that from 1000 to 1500 hp can be developed. It is expected to have the hydroelectric plant in operation within one year.

BERKLEY SPRINGS, W. VA.—The Capacon Power Company has secured a site adjoining Berkley Springs on which they will erect a plant at a cost of about $100,000. F. R. Reed, of Berkley Springs, is president, treasurer and general manager, and J. Hammond Siler is attorney.

MILLVILLE, W. VA.—P. O. Keilholtz, 615 Continental Building, Baltimore, Md., consulting engineer, has been engaged by the Winchester & Washington Railway, of Winchester, Va., to prepare plans and superintend the construction of its steam plant at Millville, which will be used as an auxiliary to its hydroelectric power plant. It is proposed to install a 2200-volt, three-phase, 60-cycle plant with an output of 1500 kw to furnish electricity for light and power purposes; also for distribution through Jefferson and Berkeley counties in West Virginia, and Clarke and Frederick counties in Virginia.

WILLIAMSON, W. VA.—Application has been made by Captain E. L. Bailey to the City Council for a franchise to install and operate an electric light and power plant at his mine, and also to furnish electrical service in this city. Mr. Bailey now secures electricity from the Williamson Light & Ice Company.

CHIPPEWA FALLS, WIS.—C. R. Brant, of Madison, Wis., and his associates are reported to be interested in a project to construct an electric railway to La Crosse via Galesville.

LA CROSSE, WIS.—The Common Council has granted the La Crosse & Winona Traction Company a 50-year franchise in La Crosse. It is expected to have the railway completed into Galesville within two years, and it will ultimately be extended to Minneapolis and St. Paul.

MADISON, WIS.—The City Council has ordered the removal of poles and wires from several of the city streets, giving the companies until Aug. 1, 1910, to do the work. The Council has instructed the Southern Wisconsin Traction Company to replace the present wooden poles with iron trolley poles on State and University streets, a distance of 12 blocks, the work to be completed within six months.

STOUGHTON, WIS.—The new $15,000 power house of the Mandt Wagon Company is almost completed. The equipment will cost about $10,000 and will include a 360-hp engine and three large generators. Five large boilers with a total rating of 550 hp will also be installed.

CALGARY, ALTA., CAN.—Plans are being considered for making an extension of about 12 miles to the Calgary street railway system during 1910. Thomas H. McCauley is general manager.

PRINCE RUPERT, B. C., CAN.—The electric light plant and saw mill at Seal Harbor, owned and operated by the British Columbia Tie Timber Company, was entirely destroyed by fire on Dec. 4, causing a loss of about $60,000.

HAMILTON, ONT., CAN.—The fire and water committee is considering the question of purchasing transformers to use at the Beach pumping station in connection with the service furnished by the Hydro-Electric Power Commission. The Canadian Westinghouse Company was awarded the contracts for the motors last year, to be used for the Cataract Power Company service. Owing to the decision to use Niagara power it is necessary to use transformers with the motors on account of the high voltage.

TORONTO, ONT., CAN.—The municipalties of Milton, Toronto Township, Port Credit, Mimico and Brampton, all in Ontario, have made application to the Hydro-Electric Power Commission for electricity. If the service is furnished another transformer station will be established.

SASKATOON, SASK., CAN.—The lighting committee has adopted a new schedule of rates for electricity for lighting purposes as follows: From 1 to 100 kw, 11 cents per kw-hour; from 101 to 150 kw, 9 cents; from 151 kw and all above that amount 8 cents per kw-hour, with a 10 per cent discount if paid within 10 days.

SASKATOON, SASK., CAN.—The Saskatchewan Power Company has submitted a proposition to the city offering to supply the city with power at less than $30 per hp per year with a 24-hour service.

## New Industrial Companies.

THE ALLEN ENGINEERING COMPANY, of Memphis, Tenn., with a capital stock of $40,000, has been organized by Thomas H. Allen and others for the purpose of doing an engineering business.

THE ALLEN ENGINEERING COMPANY, of Jersey City, N. J., has been incorporated with a capital stock of $40,000 for the purpose of manufacturing and dealing in iron, steel, coke, copper, lumber, engines, cars, etc., and constructing bridges, building boats, etc. The incorporators are: G. D. Raine, Jr.; N. Hill Martin, T. S. Allen and S. P. Walker, of Jersey City, N. J.

THE AMERICAN HYDRO-NUMATIC COMPANY, of New York, N. Y., has been chartered with a capital stock of $100,000 by C. M. Gilpin, W. M. Alberti, and H. M. Gaylord, of New York, N. Y. The company proposes to manufacture machinery.

THE AMERICAN "Z" ELECTRIC LAMP COMPANY, of Jersey City, N. J., has been chartered with a capital stock of $1,000,000 for the purpose of manufacturing electric lamps, etc. The incorporators are: H. Brunner, A. Romberg, Paris, France, and B. Treacy, Jersey City, N. J.

GEORGE R. BASCOM COMPANY, of Boston, Mass., has been incorporated for the purpose of manufacturing and selling machinery. The company is capitalized at $5,000 and the incorporators are: George R. Bascom and Guy W. Jones, both of Boston, Mass.

THE CHARLESTON ENGINEERING & CONSTRUCTION COMPANY, of Charleston, S. C., has been incorporated by T. C. Stevenson and John A. McCarmack. The company is capitalized at $10,000 and proposes to do a general engineering and contracting business.

THE ELECTROMAGNETIC APPLIANCE COMPANY, of St. Louis, Mo., has been incorporated with a capital stock of $50,000 by Harautium K. Kouyoumjian, Arthur Schwab, W. W. Selbert and others. The company proposes to manufacture and deal in electrical appliances.

THE EMMONS ELECTRIC COMPANY, of Chicago, Ill., has been incorporated by Carl T. Post, Charles P. Emmons and Henry W. Huttman. The company is capitalized at $10,000 and proposes to manufacture and deal in electrical supplies and fixtures.

THE GRANT TUNGSTEN LAMP COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $2,500 to manufacture electrical lamps and appliances. The incorporators are: Ernest O. Best, D. V. Rubidge and Edwin J. Mergard, all of Chicago, Ill.

THE HEER ENGINE COMPANY, of Portsmouth, Ohio, has been incorporated with a capital stock of $50,000 by Chris Heer, George A. Selby, G. M. Appel, Fred N. Tynes and H. W. Heer.

THE MITCHELL RAND MANUFACTURING COMPANY, of New York, N. Y., has been incorporated for the purpose of manufacturing electrical supplies, devices, etc. The company is capitalized at $20,000 and the incorporators are: Lyman F. Rand, William E. G. Mitchell and Charles L. Rand, all of Brooklyn, N. Y.

THE NEW HAVEN ELECTRIC MANUFACTURING COMPANY, of New Haven, Conn., has filed a certificate of incorporation with the Secretary of State. The company is capitalized at $50,000, but will start business with $5,000. The incorporators are: John Fruin, of Cheshire, Conn.; Henry C. Barber, of Plainville, Conn., and Epaphroditus Peck, of Bristol, Conn.

THE PRIMM OIL ENGINE COMPANY, of Van Buren, Ind., has been incorporated with a capital stock of $40,000 for the purpose of manufacturing engines. The incorporators are: J. M. Primm, B. J. Stranahan, I. C. Mills, W. B. Mills and A. B. Chauvant.

THE RAILROAD PROMOTION & CONSTRUCTION COMPANY, of Des Moines, Ia., has been incorporated for the purpose of constructing railroads operated by electricity, gasoline, steam, etc. Charles Philpot is secretary.

THE SOUTHERN GAS & ELECTRIC COMPANY, of Charlotte, N. C., has been chartered with a capital stock of $4,000 to manufacture gas engines and electrical apparatus. The incorporators are: W. D. Wilcox, William H. Monty and Albert M. Guillet.

THE UNION GAS & ELECTRIC COMPANY, of Oklahoma City, Okla., has been incorporated to do a general contracting business, including the construction of isolated lighting plants, wiring, heating, ventilating and dealing in fixtures and supplies. The company is capitalized at $50,000, and the officers are: F. L. Braniger, president; C. S. Stephenson, secretary and manager, and E. B. Brown, treasurer.

THE VACUUM SECURITIES COMPANIES, of East Orange, N. J., has filed articles of incorporation with a capital stock of $400,000 to manufacture vacuum cleaning machines and supplies. The incorporators are: K. K. Mackenzie, of East Orange, N. J.; J. M. Ryan, of New York, N. Y., and J. K. Berry, of Greenwich, Conn.

## New Incorporations.

COALINGA, CAL.—The Coalinga Water & Electric Company has filed articles of incorporation with a capital stock of $2,000,000 for the purpose of supplying water and power to Coalinga and the oil fields. The directors are: W. C. Kerchchoff, A. C. Balch, K. Cohn and A. G. Wishon.

SACRAMENTO, CAL.—Articles of incorporation have been filed for the Western Consolidated Coal, Gas & Electric Company with a capital stock of $7,500,000. The company is now operating in Arizona and intends to undertake the development of extensive coal mining claims near Stone Canyon, Cal. Under its charter the company is given the privilege of supplying electricity for lamps, heat and motors and coal in any part of the State.

SAN FRANCISCO, CAL.—The Hammon Engineering Company has been incorporated with a capital stock of $1,000,000 by W. P. Hammon, A. E. Boynton, N. Cleaveland, C. U. Black and C. S. Goodrich. The company is interested in power development work.

DECATUR, ILL.—Articles of incorporation have been filed for the Progressive Light & Power Company with a capital stock of $100,000 by W. H. Suffern, R. I. Hunt and F. M. Ives. The company proposes to generate and sell electricity.

AUGUSTA, MAINE.—The United Water & Electric Company has been chartered with a capital stock of $2,000,000 for the purpose of supplying water and electricity. R. S. Buzzell is president, and E. J. Pike, of Augusta, Maine, treasurer.

OLDTOWN, MAINE.—The Kennebec Development Company has been incorporated with a capital stock of $200,000. The company proposes to deal in gas, electricity, etc. The officers are: C. H. Briggs, of Providence, R. I., president; H. E. Green, of Waterville, Maine, treasurer.

WHITE PLAINS, N. Y.—Articles of incorporation have been filed for the Westchester Street Railroad Company with a capital stock of $1,000,000. The company is a reorganization of the former Tarrytown, White Plains & Mamaroneck Railway Company, which went into receiver's hands about two years ago, by the New York, New Haven & Hartford Railroad Company. The directors are: Richard Sutro, William Greenough, Charles H. Sheafe, Jr., William L. Barnett, John L. Anderson, Frank E. Hall, Edward O. Brown, of New York, N. Y.; John S. Parker and Augustus S. May, of New Haven, Conn.

OKLAHOMA CITY, OKLA.—Articles of incorporation have been filed for the Union Gas & Electric Company with a capital stock of $50,000 by F. L. Brandiger, C. S. Stephenson and E. B. Brown.

YUKON, OKLA.—The Yukon Electric Company has been incorporated with a capital stock of $5,000 by J. F. Kroutril, F. L. Kroutril and A. F. Dobry.

EVANS CITY, PA.—The Evans City Light, Heat & Power Company has been formed for the purpose of constructing an electric light and power plant. Samuel A. Roelofs is interested in the enterprise.

TITUSVILLE, PA.—The Titusville Railroad Company has been chartered to construct and operate an electric railway between Titusville and Cory, 20 miles in length. Gasoline motor cars will be used. The incorporators are: W. J. Smith, of Titusville, president; P. T. Carolan, of New York, N. Y.; C. H. Ley, F. S. Fleming, C. W. Hawbaker, E. J. Robertson and A. N. Egbert, all of Titusville, Pa.

ALEXANDRIA, TENN.—The Alexandria Home Telephone Company has been incorporated with a capital stock of $3,000 by James S. Sampson, J. W. Rutland, J. W. Measle, W. B. Kyle, J. R. Hudson and O. D. Adamson.

NASHVILLE, TENN.—The Kragon Electric Company has been incorporated by J. Hugh Kessett, H. Edward Smith, Herman Cook and others. The company is capitalized at $5,000.

SALT LAKE CITY, UTAH.—Articles of incorporation have been filed for the Belknap Power Company, with a capital stock of $300,000. The officers are: James Long, Jr., president; J. C. Wright, vice-president; J. Winner, treasurer.

CLE ELUM, WASH.—Articles of incorporation have been filed for the Cle Elum Traction Company by Frank S. and M. E. Farquhar, of Tacoma, Wash. The company is capitalized at $300,000 and proposes to construct an electric railway extending from Cle Elum to Roslyn, a distance of 17 miles.

MADISON, WIS.—The Melville Settlement Telephone Company, Chippewa Falls, has filed articles of incorporation with a capital stock of $5,250. The incorporators are: George W. White, James W. Melville, James P. Maloney and James Ryan.

## Personal.

MR. P. M. HAIGHT, treasurer of the Sprague Electric Company, was recently elected president of the Electrical Trades Society of New York.

MR. ORMOND HIGMAN has resigned as manager and engineer of the telephone system of the Alberta Government in order to engage in private practice, with offices in the Williams Building, Vancouver, B. C.

MR. W. E. WICKENDEN, formerly instructor in electrical engineering at the University of Wisconsin, has become assistant professor of electrical engineering in the Massachusetts Institute of Technology.

MR. LLOYD LYON, formerly secretary and auditor of the Mobile Light & Railroad Company, Mobile, Ala., has been appointed treasurer of the Mexico Tramways Company and the Mexican Light & Power Company, Ltd.

MR. J. W. CORNING, electrical engineer for the Boston Elevated Railway Company, delivered an address before the Worcester Polytechnic Institute branch of the A. I. E. E., entitled "Some Electrical Features of the Boston Elevated Railway System."

MR. ERNEST A. EDKINS has been appointed secretary of the advisory committee and superintendent of the employment bureau of the Commonwealth Company, succeeding Mr. Schayer. Mr. Edkins was formerly in the office of Vice-President L. A. Ferguson.

MR. O. H. ENSIGN, chief electrical engineer of the U. S. Reclamation Service, at Los Angeles, has been selected for membership on the advisory board of electrical engineers in charge of construction work of aqueduct power plants which the city of Los Angeles will erect at an estimated cost of $3,500,000.

MR. H. M. BEARDSLEY, secretary and treasurer of the Elmira Water, Light & Railroad Company, has also been appointed acting general manager of the company, taking up many of the duties relinquished by Mr. S. J. Dill, the general manager, who will hereafter be located in New York, as noted elsewhere in these columns.

PROFESSOR CHAS. L. KINSLOE, of the department of electrical engineering of the Pennsylvania State College, accompanied by 23 students of his department, is making a tour of inspection of places of special interest to electrical engineers in Philadelphia, Camden, Trenton, Harrison, Ampere, and New York City.

MR. JOHN J. SCHAYER has been appointed manager of Electric Shop of the Commonwealth Edison Company, Chicago, and has established his office in the Railway Exchange Building, where Electric Shop is located. The business of this handsome establishment has grown rapidly, and it now requires Mr. Schayer's entire attention.

MR. JOSEPH E. WAYNE has resigned from the commercial department of the Edison Electric Light Company, York, Pa., to become superintendent of the York Railways Company, York, Pa., in which position he succeeds Mr. F. P. Newman, who has become general manager of the Southern Cambria Street Railway, Johnstown, Pa.

MR. H. H. SEAMAN has recently been appointed assistant manager of the New York electrical department of the H. W. Johns-Manville Company. Mr. Seaman was associated for seven years with the Electric Storage Battery Company at Philadelphia, Detroit and Cleveland, and for the past two years has been manager of its Atlanta office.

MR. F. F. ESPENCHIED, consulting engineer and assistant to the general manager of the West Penn Railways, Pittsburg, Pa., has resigned from the company to become general manager of the Interstate Light & Power Company, which is building a modern transmission plant to serve Galena, Ill., and Plattville, Wis., and the intervening mining region.

MR. L. C. NICHOLS, chief electrician of the Lehigh Valley Transit Company, of Allentown, Pa., has severed his connection with that company and accepted a position with Messrs. Herrick & Stebbins, of New York, where he will devote his time to investigation and testing work. Prior to his connection with the Lehigh Valley Transit Company, Mr. Nichols was employed by the Utica & Mohawk Valley Railway Company.

MR. C. F. CRANE, general passenger agent of the Eastern Pennsylvania Railways Company, which operates the lighting plants at Pottsville, Tamaqua, Port Carbon, Minersville, Frackville, Palo Alto, and Orwigsburg, Pa., has just returned from an eight weeks' trip to Italy whither he went in search of much needed rest. Mr. Crane spent most of his time in Naples.

PROF. RALZEMOND DRAKE PARKER has received the appointment of assistant professor of electrical engineering at the University of Michigan, from which institution he was graduated in 1905. He obtained a master's degree the following year, and remained as instructor in the electrical department. Since graduation he has spent the summer months in practical work in electrical operating and manufacturing companies.

MR. PAUL WINDSOR, superintendent of motive power and rolling stock of the Boston Elevated Railway Company, presented a paper on "The Effects of Improvements in Old Types of Electric Railway Equipment on Maintenance" before the Boston Section of the A. I. E. E., on Dec. 15. "Power Station Economics" was the subject of a paper by Mr. Walter Goodenough, mechanical engineer of the Stone & Webster Engineering Corporation, presented at the same meeting.

MR. CLINTON E. PALMER, who has been superintendent of railways of the Eastern Pennsylvania Railways Company of Pottsville, Pa., for the past two years, has resigned his position to accept the post of general superintendent of the Chicago, Lake Shore & South Bend Railway Company, with headquarters at Michigan City, Ind. Prior to his connection with the Eastern Pennsylvania Railways Company, Mr. Palmer was associated with the Cincinnati & Northern Traction Company. His resignation takes effect on Jan. 1.

MR. EDWIN BENNETT, who has been appointed assistant professor of electrical engineering at the University of Wisconsin, was graduated from the Western University of Pennsylvania in 1897. Subsequent to graduation he was employed in the research department of the Westinghouse Electric & Manufacturing Company. He was for a time electrician of the Nernst Lamp Company and chief electrician of the American Telephone & Telegraph Company. More recently he was electrical engineer for the Telluride Power Company at Provo, Utah.

PROF. HENRY HAROLD HIGBIE was promoted Oct. 1 from instructor to assistant professor of electrical engineering, Michigan University. Prof. Higbie, who is from New York City, in 1896 won the Pulitzer scholarship, which gave eight years' tuition in the Horace Mann High School, New York, and Columbia University. At Columbia he won the highest honors in the engineering department, in addition to a cash award of $1,750, and upon graduation in 1904 received the Illig medal in applied science. After serving for a year as instructor at Columbia, he went to the University of Michigan in 1905.

MR. S. J. DILL, who succeeded Mr. W. W. Cole as general manager of the Elmira Water, Light & Railroad Company, has been appointed assistant to Mr. George Bullock, president of the Susquehanna Railway, Light & Power Company, New York City. Mr. Dill has also been elected vice-president of the Railway Equipment Company, through which purchases are made for the Susquehanna Railway, Light & Power Company. He succeeds to the duties with these companies previously performed by Mr. Edwin Witherby, whose resignation was announced in the *Electrical World* Dec. 9. Although Mr. Dill will make his headquarters in New York he will retain the title of general manager of the Elmira properties.

## Obituary.

MR. FRED R. FULTON, manager of the Pryor (Okla.) Electric Light Company, died in Iola, Kan., Dec. 15, at the age of 25 years.

## Trade Publications.

CONTROLLER APPARATUS.—Bulletin No. 4677, issued by the General Electric Company, contains data relative to the Sprague-General Electric system of control, and forms a revision of similar data contained in a previous bulletin on this subject. The publication contains numerous illustrations showing the various pieces of apparatus used in connection with this system, with a description of each. It also contains a table of weights of this style of equipment for various horse-power ratings.

SMALL DIRECT-CURRENT MOTORS.—The application of small motors to laundry apparatus, printing presses and other machinery with similar requirements, has brought about changes and improvements in the respective industries which are having an important effect on their development. For this reason bulletin No. 118, just issued by the Crocker-Wheeler Company, of Ampere, N. J., describing apparatus of this type, is of interest for every up-to-date manufacturer. The pamphlet is well illustrated with engravings, showing applications of motors to various types of machinery.

SINGLE-PHASE MOTOR.—Bulletin No. 4675, issued by the General Electric Company, describes and illustrates a new single-phase induction motor of the repulsion induction type, developed for use in connection with installations where the starting torque of the resistance-reactance type of induction motor will not meet the demand of the driven machine, or where within certain limits invariable speed is required. The bulletin mentions various applications of this type of motor, illustrates and describes controllers for use in starting and in varying the speed, and contains certain other data including diagrams of connections.

CONDUITS AND CIRCUIT FITTINGS.—The Central Electric Company, Chicago, is distributing three new circulars descriptive of condulets and their application. A number of illustrations show the method of employing condulets in connection with pole type transformers, interior lighting, etc. Other recent publications of the same firm are a flier descriptive of meter connection blocks intended for use in installing and testing induction type service meters, and a circular devoted to a description of Alphaduct Flexible Conduit. Particular attention is called to the fact that this conduit is flexible, moisture proof, and will withstand any climatic changes.

## Business Notes.

BELTED RAILWAY GENERATORS.—The National Machinery & Wrecking Company, Cleveland, Ohio, has issued a special bargain list on 5000 kw in belted railway generators of practically all sizes.

FIFTEEN HUNDRED LIGHTNING ARRESTERS SOLD TO ONE CUSTOMER.—The Lord Electric Company, New York, has been much gratified to learn that of 1500 lightning arresters sold during 1909 to a single customer, not one has proved defective.

THE GOODWIN & KINTZ COMPANY has opened a salesroom at 25 West Broadway, Crockery Exchange Building, New York, where in a handsome and well-lighted office it displays a full line of gas and electric portables, electroliers, dining-room domes, art-glass shades and other lighting specialties.

THE Q M S COMPANY (Quincy, Manchester, Sargent), Plainfield, N. J., announces that on Jan. 1 it will move its Western office from 1775 Old Colony Building to 738 First National Bank Building, Chicago, and that its interests in the West will hereafter be taken care of by Mr. John C. Hoof.

B. & W. BOILERS FOR ATLANTIC CITY POWER HOUSE.—The American Gas & Electric Company has selected Babcock & Wilcox boilers for the new power house at Atlantic City. Each of the four 500-hp boilers is to be equipped with a six-retort Taylor gravity underfeed stoker.

HYDRO-GROUND.—The Lord Electric Company some months ago placed on the market a device known as the "Hydro-Ground," which, it reports, is meeting with remarkable success, duplicate orders being received from various branches of the trade to be used in all classes of operation. The "Hydro-Grounds" is now in use on telephone and telegraph circuits, signal circuits, wireless telephone and telegraph circuits, and electric light, power and railway circuits wherever, in fact, a ground is desirable or necessary. A large company which several months ago installed quite a number of the device is now placing an order for several hundred, stating that it is the only commercial and legal ground yet found.

ALLIS-CHALMERS PACIFIC SLOPE OFFICE.—The San Francisco office of Allis-Chalmers Company has been moved from 599 Mission Street to the Byron Jackson Building, 160 Second Street, corner Natoma Street, in order to accommodate its increased selling force. The territory is in charge of Mr. R. B. Elder, who has been engaged in engineering on the Pacific Coast for the past 14 years. An attractive office has been provided with greatly increased facilities for the handling of the company's products, and with the advantages of a warehouse containing a complete assortment of small machinery such as breakers, motors, transformers, repair parts, etc., prompt and satisfactory service is assured.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED DEC. 14, 1909.

[Conducted by F. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

942,894. ELECTRIC HEATER; R. Farren and C. T. Clark, Cleveland, Ohio. App. filed Dec. 3, 1908. Heater and radiator in which the water circulates around tubes heated by coils therein.

942,897. APPARATUS FOR RECEIVING SUBMARINE SOUNDS; T. A. Garrett and W. Lucas, Crouch End, England. App. filed Aug. 31, 1909. Uses a magnetized nickel rod surrounded by a coil of wire as transmitter, thus doing away with a carbon transmitter. One end of the rod is connected to the side of the vessel and a mass is fixed to the other end to put it in resonance with the sound.

942,901. APPARATUS FOR ELECTRICALLY IGNITING GAS-BURNERS; Alfred J. Hill, Woodford Green and F. C. D. Mann, Hayes, England. App. filed Jan. 4, 1909. A pair of insulated brackets mounted on the baffle plate with tubular arms, electrodes therewithin forming a spark gap.

942,960. STARTING SWITCH FOR ELECTRIC MOTORS; E. Garside, Darlington, England. App. filed Sept. 8, 1909. Cuts out resistance by a movable switch arm with dash pot, piston and carriage connected to the piston, the carriage carrying a contact connectable to the switch arm.

942,961. TRANSFORMER FURNACE; E. A. A. Grunwall, A. R. Lindblad and O. Stalhane, Ludvika, Sweden. App. filed May 2, 1907. Induction furnace for smelting having a primary coil and coils placed in the path of leaking lines of force so arranged that the magnetomotive-force generated by the coils will counteract the leaking lines.

942,963. BERTH-LAMP; W. S. Hamm, Hubbard Woods and T. A. Legge, Chicago, Ill. App. filed April 17, 1909. For berths of sleeping car, the lamp being within a wall pocket when not in use and carried by a pivot.

942,964. ELECTRIC-LIGHTING ATTACHMENT FOR BURGLAR-ALARM SYSTEMS; M. F. Juruick, New York, N. Y. App. filed Aug. 16, 1907. Throws the electric lamps in circuit when the burglar enters and rings an alarm, the alarm circuit being normally open and closing the lamp circuit through a drop.

942,981. ELECTRIC CONTROLLER; C. L. Taylor, Alliance, Ohio. App. filed March 6, 1909. For traveling cranes. Includes a series of conducting bars having arms carrying resistance elements electrically connected therewith.

942,990. STORAGE-BATTERY TANK; T. A. Willard, Cleveland, Ohio. App. filed May 14, 1907. An outside casing with a protecting coating and lead lining with a meltable layer between them so that they can be separated for repairs.

943,011. CONTROL SYSTEM FOR ELECTRIC MOTORS; A. C. Eastwood, Cleveland, Ohio. App. filed May 24, 1909. For two or more motors having series fields with a single set of reversing switches for reversing the current through the series field of all the motors.

943,016. ELECTRIC SWITCH; M. Guett, Hartford, Conn. App. filed Feb. 7, 1906. A face plate for plug receptacles with apertures and a pair of shutters for closing them.

943,047. APPARATUS FOR STARTING AND STOPPING ELECTRIC MOTORS; C. Spannagel, Mannheim, Germany. App. filed June 1, 1909. A control member, a switching member, two springs between them, a solenoid and a double pawl operated by the solenoid and acting upon two notched rims.

943,076. KEYLESS SOCKET; H. Hubbell, Bridgeport, Conn. App. filed Jan. 2, 1909. Two metal members with a threaded connection, a base with an annular shoulder carrying a screw shell and an insulating lining.

943,077. DETACHABLE CHAIN-GUIDE FOR PULL-SOCKETS; H. Hubbell, Bridgeport, Conn. App. filed July 23, 1909. A detachable chain-guide comprising a bell and bar having lugs.

943,078. MEANS FOR LOCKING ELECTRIC SOCKETS TO FIXTURES; Harvey Hubbell, Bridgeport, Conn. App. filed Sept. 4, 1909. For locking the cap to the bushing, the bushings being threaded and the fixture being threaded to engage them.

943,115. SELECTIVE SIGNALING APPARATUS; O. M. Leich, Rochester, N. Y.—App. filed Feb. 3, 1905. Supplies currents of different frequency, each to a substation and uses a selective signaling apparatus responsive to alternating-current of a given frequency, and also a second signaling apparatus with a non-resonant path and a serial impedance to cause a selective operation between the frequencies.

943,124. SWITCH-HANDLE; C. Schuster, Bellevue, Pa. App. filed Nov. 7, 1908. Non-conducting handle with a lateral socket to receive the blade terminal.

943,132. PROCESS OF PRODUCING NITRIDS; C. E. Acker, New York, N. Y. App. filed March 18, 1909. Repeatedly reacts with nitrogen on an alloy containing a nitrid-forming metal, separates and realloys.

943,147. WINDOW-SPRING; J. Hagerty, Scott Township, Allegheny Co., Pa. App. filed Dec. 21, 1908. When the spring is tampered with or the window moved, the bell rings. The sash carries a roller and a spring pressed lever controlling a circuit is contained in a metallic frame secured to the window casing.

943,155. ELECTRIC MOTOR; L. A. McCoubrie and C. F. Raydure, Philadelphia, Pa. App. filed April 29, 1909. Prevents forming ribs on commutators by special brush holder consisting of a hollow slotted casting, the slots of successive holders alternating in relative position, with springs for pressing down on the brushes.

943,166. ELECTRIC CONTROLLING APPARATUS; W. Schwagermann, Yonkers, N. Y. App. filed July 31, 1907. An electric motor with a reversing rheostat comprising two hand-controlled starting levers one of which starts the motor in one direction and the other in the other direction and a no-voltage device for each lever.

943,187. ELECTROLYTIC WATER-PURIFYING APPARATUS; H. B. Hartman, Pittsburgh, Pa. App. filed March 2, 1908. Keeps the plates clean and gives the oxygen time to act. Uses a plurality of electrodes with intermediate bipolar electrodes enclosed by a casing through which the liquid flows. Reverses the current.

943,188. METHOD OF PURIFYING WATER ELECTROLYTICALLY; H. B. Hartman, Pittsburgh, Pa. App. filed March 2, 1908 (See No. 943,187.) Causes the liquid to flow downwardly between long electrodes in a closed chamber and synchronously interrupts the flow of current and of the liquid, and reverses the current. The liquid is caused to flow rapidly.

943,190. ELECTRIC CHAIN-LINK-WELDING APPARATUS; C. L. Hoff, York, Pa. App. filed Dec. 5, 1907. The welding jaws are movable toward and from each other; a guide between the jaws positions the link, the guide being moved out of engagement with the link while the latter is heated.

943,196. ELECTRIC-RAILWAY SYSTEM; G. H. Maire, Seattle, Wash. App. filed Nov. 29, 1907. Prevents two cars from entering the block simultaneously. The line circuit has a normally open section controlled by a switch operated by the car.

943,215. ELECTRIC SWITCH. H. J. Carrigan and A. J. Sangster, Buffalo, N. Y. App. filed Sept. 22, 1908. Combination lock for induction coils for automobiles. An annular row of contacts, with two rotating arms, an outer hollow shaft for one arm and an inner shaft carrying the other.

943,224. ELECTRIC FURNACE; E. A. A. Gronwall, A. R. Linblad and Otto Stalhane, Ludvika, Sweden. App. filed July 28, 1909. Special shape of furnace. Heating chamber and stack with a free space between the charge and the top of the chamber. Electrodes enter the wall of the chamber.

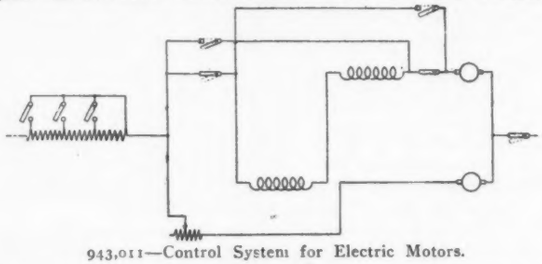
943,232. COMBINED BURGLAR-ALARM AND AUTOMATIC CAMERA; J. C. Ashe, Montreal, Quebec, Canada. App. filed Oct. 19, 1908. A movable floor section starts arc lights which ignites a fuse that controls a drop which releases the photographic plate of a camera to take the burglar's picture.

943,273. ELECTRIC-LIGHT SOCKET; R. A. Schoenberg, New York, N. Y. App. filed Feb. 20, 1909. A solid insulating base carrying a lock which locks the lamp to the base.

943,274. MECHANICAL MOVEMENT; R. A. Schoenberg, New York, N. Y. App. filed July 24, 1909. For make-and-break contacts in a lamp socket in which a reciprocating rod carries cam surfaces which actuates a driven member through a compression member.

943,275. BATTERY-ELEMENT SUPPORT; C. B. Schoenmehl, Waterbury, Conn. App. filed April 1, 1909. A pair of guide wires carries two channel strips and a sheet metal spring below the lower strip holds the plate between the strips.

943,281. ELECTRICAL CONTACT DEVICE; J. M. Smith, Philadelphia, Pa. App. filed Jan. 13, 1909. To prevent wires jarring out of binding posts by making a special spring pressed post.



943,011—Control System for Electric Motors.

943,287. CONDUIT-CAP FOR ELECTRIC INSTALLATION; W. H. Vibber, New London, Conn. App. filed May 10, 1909. A U-shaped frame with a removable hood having a U-shaped opening removably secured to the frame with an insulating cover for the hood.

943,290. ELECTRIC FURNACE; C. E. Wilson, Hood River, Ore. App. filed Feb. 1, 1909. For reducing wolframite to make tungsten. The furnace has removable and replaceable sides and can be raised and lowered. A stationary electrode projects into the furnace.

943,345. STORAGE BATTERY; L. H. Flanders, Wilkinsburg, Pa. App. filed Feb. 23, 1905. A separator, plate comprising superimposed obliquely extending and intersecting members with a binding frame having holding lugs.

943,368. BURGLAR-ALARM SCREEN; P. Orance, Newark, N. J. App. filed Aug. 4, 1908. A roll having levers whose ends are secured to wires which when broken cause the levers to close an electric alarm circuit.

943,384. ELECTRIC HEATER; R. W. Brown, Amsterdam, N. Y. App. filed Oct. 22, 1908. Reinforced cement unit in which is embodied a heating wire coil, a metal prism surrounding the body and receptacle to receive the prism.

943,403. MELTING HEARTH FOR ELECTRIC INDUCTION-FURNACES; C. Grumwald, Bredeney, Germany. App. filed May 7, 1909. Has a melting trough with lateral serving openings, the shape of the trough permitting inspection and access through the openings.

943,440. ALARM APPARATUS; F. P. Moyer, Utica, N. Y. App. filed Jan. 22, 1909. Actuated by fire, smoke or water. A casing having walls consisting of diaphragms coated with a catalytic substance which reacts with the gases to cause the diaphragm to operate a circuit.

943,483. ELECTRICALLY-HEATED TOOL; Geo. E. Stevens, Lynn, Mass. App. filed Aug. 4, 1908. For sad irons, etc., a circuit controller is spring pressed to open position, locked closed by a latch. The latch is spring pressed, the spring being capable of a limited movement before the latch is moved.

943,503. DYNAMO-ELECTRIC MACHINE; J. B. Wiard, Lynn, Mass. App. filed Dec. 6, 1905. Avoids disturbing jars to the motor when the loom or machinery driven thereby suddenly stops by connecting the motor armature to the shaft by a yielding connection. Makes use of helical springs and friction members.

943,509. ELECTRICAL CABLEWAY SYSTEM; O. Adams, Dresden, Germany. App. filed April 20, 1908. An endless cable, a straining rope to keep the cable under uniform tension, an electric motor for operating the cable and straining rope, and a compensating generator driven by the straining rope operating element of the motor and energizing a compensating winding in the motor circuit.

943,531. PENDULUM ELECTRICITY-METER; C. Fery, Paris, France. App. filed Jan. 12, 1909. Two electrically controlled pendulums which are automatically started and run without solid friction. The coincidences of the pendulums are obtained by a rotary field motor.